MARCH 23, 1959
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RESEARCH and DEVELOPMENT news issue
Product Engineering
McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT
RECOVERY SPACE...
see page 17
HOW MUCH APPEARANCE DESIGN DOES A PRODUCT NEED?
...see page 28

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Product Engineering Editors write the articles themselves when objectivity and speed are essential . . .

Unbiased evaluations of products, processes, methods, are subjects of 14 staff-written feature articles published in the past six months.

R & D: Can it pay for the small company? Oct 6
What you need for a better laboratory. Oct 13
Modern tools for the draftsman. Oct 13
When model shops pay off. Oct 13
When choosing the right motor. Oct 13
Passport to tomorrow's new products. Dec 29
Solution by analogy. Jan 26
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What's new about the new papers. Feb 16
ASLE's gear symposium. Feb 16
One-man engineering firm. Feb 23
Electromachining speeds its attack. Mar 2
Welcome inventors: from ideas to profits. Mar 9
The engineer's bookshelf. Mar 30

20 engineer-editors, specialists in this wide range of subject matter, are ready to take on any assignment at the crook of the chief editor's finger.

And Editor Tangerman has shown the way. His description of "How Moscow Designs" (July 14, '58) won a Merit Award in the Fifth Annual Jesse H. Neal Editorial Achievement Awards announced last week.

DON'T MISS THEM!

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

March 23, 1959 Vol. 30 No. 12

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Product Engineering ..... SIDELIGHTS

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● **Two months late and some 785 lb light** the US followed USSR's lead and put a gold-plated cone into orbit around the sun. We're now batting .200 on moonshots (1 for 5) and .467 on satellites (3 for 5 Explorers, 2 for 8 Vanguards plus Discoverer and Atlas). Total for all published tries is 8 for 20. When people start making that trip (and returning—p 17) we'll have to offer them a heck of a lot better than an even chance of getting home safe.

● **Engineering job titles** (p 25) have fascinated us for some time. You can spend hours trying to imagine the duties of a *director of research-associated interests*, for example, or a *specialist in personnel and experimental control*. How would you like to be a *project gage engineer*, or an *analytical engineer* (aren't we all?), or a *principal engineer*? Which brings us to a problem in job titles a manufacturer we know struggled with for a month. Seems he had a complex filtering system in his plant that automatically bypassed, flushed and cleaned itself under the control of a specially designed, built-in computer. What were they to call the man who serviced the system? The research department came up with a suggestion and management bought it. The job now officially calls for a *thinking filter's man*.

● **The Design Engineering Conference and Show** are scheduled for Convention Hall in Philadelphia this year. Conferences will be held in the mornings and over 400 exhibitors will open their booths in the afternoons of May 25-28. Most of the PRODUCT ENGINEERING staff will be there (our booth is number 1300), and we'll be delighted to meet you and solve the world's engineering problems over a cup of coffee and frankfurter.

MARCH 23, 1959 **PRODUCT ENGINEERING** Vol. 30, No. 12
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INSIDE A

CAMERON FORGING

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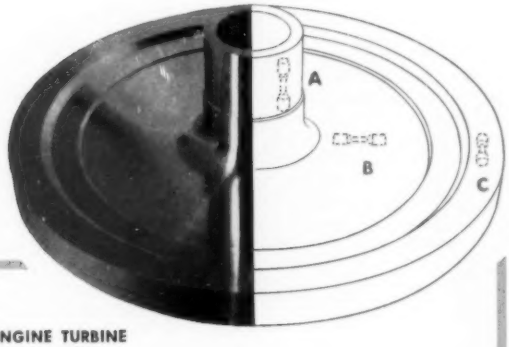
AMS-6407 LANDING GEAR COMPONENT MUST WITHSTAND UNUSUAL STRESSES.

Typical Properties

		Tensile Strength	Yield Strength	Elongation	Reduction of Area Transverse
A	Tube, Transverse	236,000	203,000	12.7%	45.1%
B	Fork, Transverse	233,000	205,000	10.6%	31.9%



A-286 JET ENGINE TURBINE WHEEL OF SPECIAL ALLOY MEETS UNUSUAL DEMANDS.

Typical Properties

		Tensile Strength	Yield Strength .2% Offset	Elongation	Reduction of Area
A	Hub, Longitudinal	158,000	117,000	22.2%	40.0%
B	Web, Radial	159,000	116,000	21.3%	40.0%
C	Rim, Tangential	162,000	117,000	20.3%	39.7%

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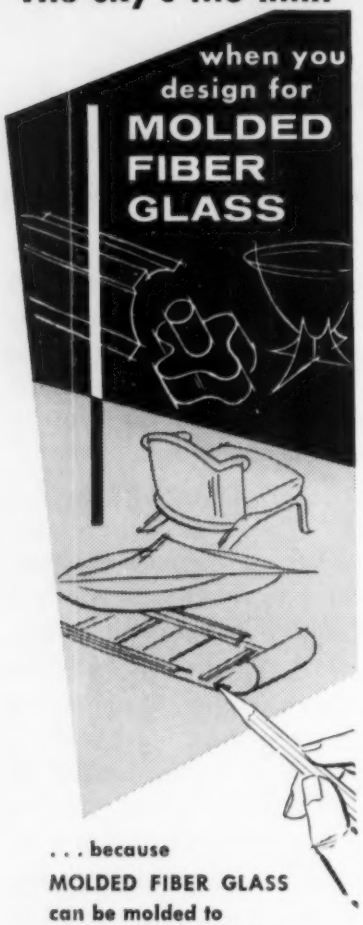

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Reader Editor...

Who Said the World Is Flat?

To the Editor:

In your editorial ". . . It's what we know that ain't so" (Feb 2, p 39), the Greek modelmakers of 65 BC were but copyists too. Isaiah wrote sometime between 774 and 732 BC concerning the creater of it all, Jehovah, that "It is He that sitteth above the circle of the earth . . ." (Isaiah 40:22—American Standard version).

And what does the "circle of the earth" sit on? "He is stretching out the north over the empty place, hanging the earth upon nothing." (Job 27:7—New World Translation). This was written not 2000 years ago, but 3500 years ago, sometime between 1657 and 1593 BC.

—Jack P Blomgren
Aerovox Corp
Myrtle Beach, SC

To the Editor:

Could it be that the "what we know that ain't so" is in this case involved with the time that the model solar system was actually made? After all, the time is still only an opinion—and therefore still open to question. It is therefore possible that in this case the crank was made by a "crank."

—R M. Fiandt, *director*
Product Design and Development
Globe-Union Inc
Milwaukee

• A number of readers have expressed surprise at the statement that a working model of the solar system was made in 65 BC in Greece (PE—Feb. 2, p. 39). George Sarton, in his "History of Science", Vol. II, soon to be published by Harvard University Press, provides some interesting dates in this connection.

Of the nine Greek Muses, seven were patron goddesses of various forms of poetry, one of history, and one, Urania, of astronomy. Thus science was recognized and represented even in very early times. Sarton points out that the spherical shape of the Earth was recognized by the early Pythagoreans (500 BC)—although many geographers of the time thought this of no practical importance. Eratosthenes of Cyrene (Circa 276-194 BC) fourth librarian at Alexandria and one of the greatest of geographers, measured Earth circumference as 252,000 stadia (39,960 km), as compared with our present figure of 40,120 km. Before him, Aristotle had estimated 400,000 stadia, Archimedes 300,000. (His successor, Aristophanes, systematized punctuation—which was not adopted until the mid-sixteenth century).

Aristarchos of Samos (Circa 280 BC) wrote a treatise on the sizes and distances of the sun and moon. It was incorrect numerically, but it did attain relative sizes and distances. He also put the center of our universe in the Sun instead of the Earth, assumed daily rotation of the Earth about its own axis and annual rotation about the Sun. He also conceived the fact that all the planets circle the Sun, except the Moon, which circles Earth. Thus he arrived at the Copernican universe 18 centuries before Copernicus! In fact Heracleides of Pontos had postulated daily rotation of the Earth and regular rotation of some planets about the sun even earlier. However, all these postulations were faulty in that they assumed circular orbits; not until 1609 did Johannes Keppler publish his findings that planets orbit in ellipses.

It is obvious from these historical dates that a model built in 65 BC would not be considered very exceptional—the facts on which it was based had been known for over 200 years!—EJT

Ever Try Tearing Pages?

To the Editor:

I direct your attention to the Editor's note in your issue of Jan 5, p 28: the little story about the toilet paper never tearing at the holes is most apropos. Of what?

Why, of trying to tear the "Design Roundup" sheets from your magazine, that's what. Have you tried it lately, unassisted by tools and implements? Sorry to be critical, but you were wide open.

—Jack Gunn
Berkeley, Calif

Watt's Crank

To the Editor:

In your Feb 2 issue (p 39) you mention "stories about Watt inventing the crank." The story I heard was that Watt found the crank had been patented so he devised a sun-and-planet device to transmit the thrust of the connecting rod into rotation of the shaft. Who knows who cut the gears for him? —Edwin R Norris
North East, Penna

CORRECTION: In "Tap the Reserve Strength in Metal Parts," Sep 29 '58, the next to last equation on page 47 should be corrected as follows: k^3_e/K should read k^3_e/K, and $K^2/2$ should read $K^2/3$. This error does not affect the equations and charts for the other sections.

CORRECTION: "When Air is the Coolant," Feb 16, p 54, L/D correction charts on last page should say "For laminar flow only"—our error of omission. However, the given values of ρDV go only up to 100 lb(mass)/ft-hr, which corresponds to a Reynolds number of about 2200 (air is assumed to be at 20 C). Therefore only the laminar region—none of the turbulent —is plotted on the L/D charts, insuring proper usage.

DEVELOPMENTS TO WATCH...

A

Three new industrial fibers . . .

. . . were unveiled last month, and more are on the way.

Last month's trio (by American Viscose, American Enka, and Courtauld's Ltd) are cellulosic fibers that feature dimensional stability—wet as well as dry—and ability to accept many of the treatments applied to cotton. They'll be heading for market soon.

A little further away from commercialization, but well along in research, are at least 3 more rayon-type fibers. Avisco is working on a high-strength fiber for possible use in V-belts, tires, and conveyor belts. Chemically resistant fibers are being developed for liquid and gas filtration; and there is at least one new cellulosic that shows promise for mechanical use.

Improved transparent plastics . . .

. . . are coming from at least two domestic sources:

Foster Grant Co, Leominster, Mass, says new production facilities will make it possible to turn out commercial quantities of a styrene-acrylonitrile copolymer that's "almost crystal clear," resists gasoline, acids, alkalis, and many naphtha solvents, and shows good resistance to impact. It's now being evaluated, should be commercially available this summer.

Also ready for design evaluation (but only in limited quantities) is a boilable acrylic polymer developed by J T Baker Chemical Co, Phillipsburg, NJ. This one is similar in optical and mechanical properties to the standard methyl methacrylate plastics; but, says Baker, its heat distortion point is 50 F higher so that it "may be immersed indefinitely in boiling water without affecting its water-white transparency."

Stronger, more-ductile welds in reactive and refractory metals . . .

. . . are promised by new high-vacuum, electron-beam welders now reaching the application stage. At least six companies have developed or licensed such machines, and at least two—Air Reduction and High Vacuum Equipment—are ready to produce them on order.

Says Air Reduction: "This new type of welder applies a high-intensity electron beam to weld beryllium, molybdenum, tantalum, zirconium, and other exotic metals . . . difficult to weld by conventional techniques."

Key to success of the new machines is the high vacuum that prevents weld contamination. Beam is controllable in dia. down at least to ⅛ in. in the commercial units, and even lower in several now under development.

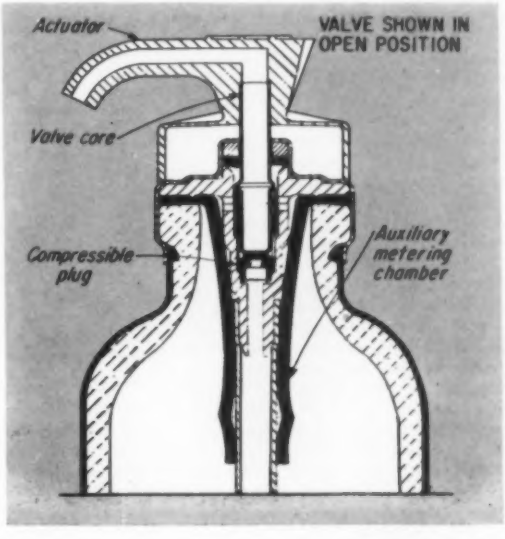
High-capacity metering valve . . .

. . . termed a "major breakthrough" in its own field, and incorporating a design feature that may prove useful in others as well, is announced by the Valve Div of Risdon Mfg Co.

Key to the new design, says Risdon's research director, is an auxiliary metering chamber, made of Buna N (NBR nitrile rubber), which surrounds the main metering chamber and makes it possible to dispense foam, spray, or liquids in measured quantities of 0.15 to 2.5 cc (150 to 2500 mg).

When the actuator is pressed, the downward thrust of the core causes the plug to expand. This seals off the material in the feed chamber or container below and, at the same time, opens the meter orifice, allowing the material in the metering and auxiliary chambers to escape.

Risdon expects to have it on the market for aerosol use "in the near future." —ARG



Spray valve has molded rubber auxiliary metering chamber for dispensing relatively large, pre-measured doses.

(Advertisement)

SPECIAL REPORTS ON FINISHING NON-FERROUS METALS

NUMBER III—Lustrous, Corrosion-Resistant Finishing with Chemical Polishing Iridite®

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

Chromate conversion coatings are widely accepted throughout industry as an economical means of providing corrosion protection, a good base for paint and decorative finishes for non-ferrous metals. Certain of these coatings also possess chemical polishing abilities that have luster-producing, as well as corrosion-inhibiting, effects on zinc and cadmium plate, zinc die castings and copper alloys. However, continued developments in this field have been so rapid that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this discussion of the many ways in which this chemical polishing characteristic can be used in final finishing or pre-plating treatments to produce a lustrous appearance with distinct display and sales appeal and appreciable savings in cost. Report I on decorative, corrosion-resistant finishes and Report II on paint base corrosion-resistant finishes are available on request.

The degree of luster possible on a surface is a function of the degree to which the surface can be smoothed. Leveling to provide a smooth surface can be achieved by mechanical or chemical means, or a combination of these, depending upon the luster desired and the original condition of the metal. Chemical polishing effectively imparts luster otherwise difficult and costly to obtain. For this reason, it is often used to supplement or entirely replace mechanical polishing, depending upon the application and the original condition of the metal. Chemical polishing has the additional advantage of providing overall treatment of the submerged part. It reaches into even the deepest corners and recesses that are otherwise inaccessible. Certain of the Iridites are specifically designed to perform this chemical polishing operation. Also, they provide corrosion protection as do all Iridites, thus may be used as a final finish or a pre-plating polish.

If Iridite is to be used as a final finish, in contrast to pre-plating treatment, the chromate conversion coating generated is allowed to remain, providing good corrosion resistance. Color inherent in these Iridite films ranges from a yellow cast to yellow iridescent. These coatings may be used without further treatment where this color is acceptable and good corrosion resistance is desired. Further, these basic coatings can be tinted by dyeing. Among the dye tints available are shades of red, yellow, blue and green. If desirable, the basic coatings can also be modified by a bleach dip leaving a clear bright or blue iridescent finish. In all cases bleaching reduces corrosion resistance.

As examples of this type of final finishing, Iridites #4-73 and #4-75 (Cast-Zinc-Brite) make possible for the first time, lustrous chemical polishing of the as-cast surface of zinc die castings. Thus, in many cases, sizeable savings in finishing cost are realized by elimination of plating costs. This economical method can be used on tools, appliance parts, toy pistols, locks and many other small castings. Another example is the treatment of copper and brass parts, such as welding tips, to eliminate buffing and provide additional corrosion resistance. In many cases, handling costs are reduced appreciably by replacing piece-part handling with bulk processing. Still another example of the use of this chemical polishing and protective quality of Iridite is a simple system of zinc plate, Iridite and clear lacquer instead of more costly electroplated finishes. Typical of this type of lustrous finish are builders hardware and wire goods.

As a pre-plating treatment, in contrast to final finishes, Iridite can be used to chemically polish zinc die castings or copper prior to plating. In such cases, Iridite should be applied as an in-process step, so that the protective film is removed before the plating cycle. The savings in handling, material and labor costs are obvious. This process has made it practical to plate chrome directly over copper on steel, conserving nickel, yet producing a lustrous chrome finish. Used after stripping faulty plate in reprocessing zinc die castings, Iridite restores luster to the casting, thus making possible replating without blistering.

Other Iridite finishes are available to produce maximum corrosion resistance, a wide variety of decorative finishes and excellent bases for paint on all commercial forms of the more commonly used non-ferrous metals. As a final finish, appearance ranges from clear bright to olive drab and brown and many films can be bleached or dyed. As a paint base Iridite provides excellent initial and retentive paint adhesion and a self-healing property which protects bare metal if exposed by scratching. Iridites have low electrical resistance. Some can be soldered and welded. The Iridite film itself does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of their top performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product demands the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.

DEVELOPMENTS TO WATCH...

world-wide

Polycarbonate resin that stands —150 to 243 F . . .

. . . is reported by Farbenfabriken Bayer AG of West Germany, pioneer in polycarbonate development. Named Macrolon, the new formulation is said to retain all the desirable mechanical and electrical properties of the basic resin including toughness and transparency (*PE*— Sep 29 '58, p 36). Bayer foresees its use in acid accumulators, coil forms, precision instrument parts, sight glasses, and housings.

"Sweat-cooled" materials . . .

. . . might be one solution to the problem of providing structural parts for service at temperatures above 1550 F, says F. Eisenkolb of the German Academy of Sciences. These would be porous, powdered-metal parts designed to dissipate heat by "pedspiration" (evaporative cooling), much as humans do. "Some technical difficulties have still to be overcome," he says. But they do look promising. Other approaches, more standard in nature, are metal-ceramics and intermetallics. Titanium carbide-base cermets, he notes, have found practical application at temperatures to 2000 F. Among the most promising intermetallics are molybdenum disilicide (*PE*—Nov 3 '58 p 8) and nickel-aluminum.

On a performance basis, wood bearings can replace . . .

. . . cast iron and nonferrous metals in farm equipment, machine tools, and propulsion units, Soviet engineers claim. Wood friction bearings made by a new process outlast metal by as much as 300%, particularly when water is the lubricant. Furthermore, the Russians say, use of the wood bearings markedly reduces shaft wear. Steel axles of farm plows equipped with wooden bearings last as much as 40% longer than those with metal.

The process, developed at Woronesh Wood Technical Institute, involves an apparently simple and low-cost steam treatment (at about 212 to 230 F), during which the wood is bent to shape. This is followed by drying in shaped molds. In some cases, bearings are then soaked in an oil bath (at 212 F) for about a week.

Bearing blanks are cylinders cut from birch, aspen, alder, linden, or willow and then sliced into disks. One key to success, the Russians say, is to make sure that, in forming the bearings, the disks are so arranged that the wood fibers will be perpendicular to the bearing's journal surface.

Standard-frequency sources designed in England and Switzerland . . .

. . . point up the growing importance of accurate timing in engineering research.

The British entry (see photograph) is especially compact and flexible in design. It's a portable, transistorized unit that provides switched, standard output frequencies of 10 kcs, 1 kcs, and 100 cps and 50 cps, at a tolerance of 3 ppm. It incorporates a crystal oscillator and binary decade dividers; is available in both plug-in and battery models, with a synchronous internal crystal clock or external synchronous motor. Over-all dimensions are 12 by 8 by 7 in. Prices (in Britain) range from about $350 to $380 (US equivalent, depending on power source) from Venner Electronics Ltd, Kingston Bypass, New Malden, Surrey.

The Swiss crystal clock is a quartz unit said to be unusually reliable in operation. It's larger than the Venner unit (18 by 18 by 15 in.), but generates 60 cps as well as 50 cps, is said to have a rate variation of less than 1/100 sec/day. This one, available in the US through Freeport Engineering Co, is a plug-in unit, designed for use as a master timepiece as well as a frequency standard. —ARG

British crystal clock is designed for plug-in or battery operation, has built-in short-circuit protection.

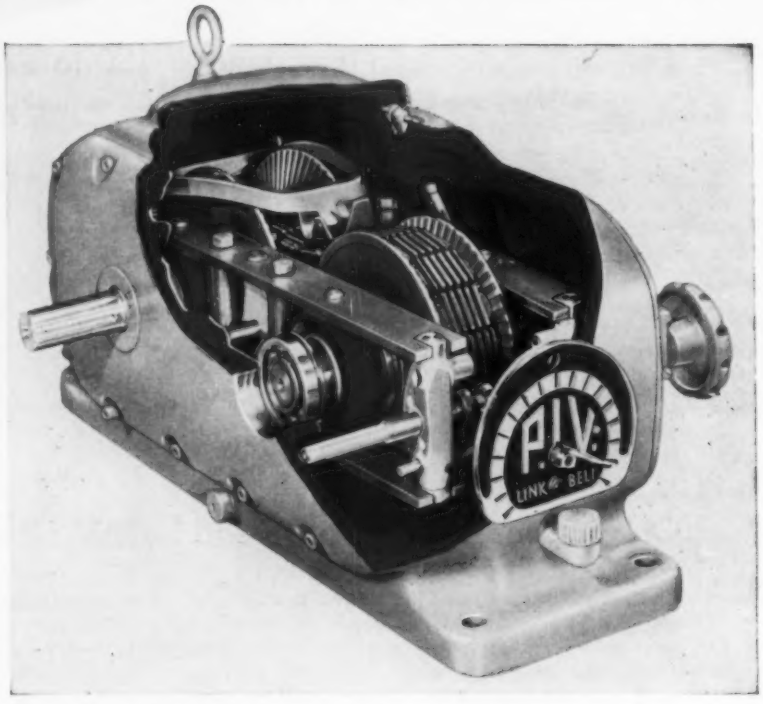
LINK-BELT P.I.V. means positive, infinitely variable speed control

Where modern production machines and operations demand extremely accurate transmission of power with variable speed control, no other variable speed drive can match the efficiency of the Link-Belt P.I.V. Here's how it works.

Because it employs an exclusive metal, self-tooth-forming chain, Link-Belt P.I.V. permits instant and accurate speed changing without perceptible loss of speed—regardless of load. And the variation can be accomplished without stopping the driven machine.

A mere turn of the control screw simultaneously varies effective diameters of conical wheels located on the input and output shafts. In turn, these radially grooved wheels mesh with the self-tooth-forming chain assuring positive selection of speed.

Call your nearby L-B office or authorized stock-carrying distributor for Book 2274.



LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

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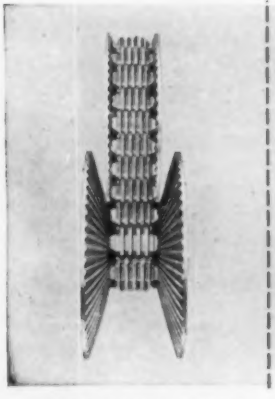
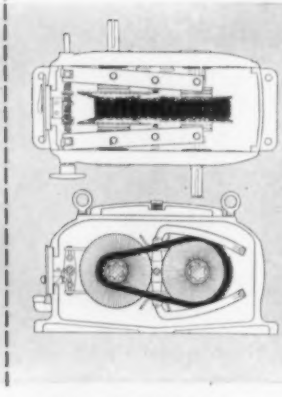
LONG-LIFE ACCURACY and application flexibility of Link-Belt P.I.V. are unmatched by any other variable speed drive. It's available in 8 sizes and 16 standard types, in capacities from ½ to 25 hp—for horizontal or vertical mounting. Compact design simplifies installation as a separate unit or a built-in part of a machine. Even greater application flexibility can be gained by making motor and helical gear sets integral parts of the P.I.V. Of all-metal construction, P.I.V. is totally enclosed, automatically lubricated.

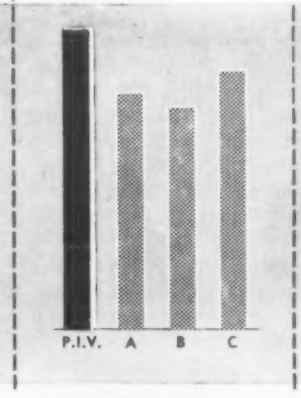
How LINK-BELT P.I.V. differs from other variable speed drives



POSITIVE MESH of self tooth-forming chain with grooved wheels assures full-rated hp at output shaft. All-metal construction . . .



PREVENTS SLIPPAGE because the P.I.V. drive chain does not depend on friction and is unaffected by atmospheric conditions.



UNMATCHED ACCURACY is demonstrated by this actual comparison of maintained rpm of P.I.V. and three other variable speed drives.

GREATER COMPACTNESS results from short-center arrangement of drive mechanism. Some P.I.V. models save 50% on floor space.

The atomic patent case . . .

which has created a great deal of interest among scientists, engineers and inventors, is being decided by the Supreme Court.

Evidence of the general interest in the case of nuclear physicist Jerome S. Spevack versus the Atomic Energy Commission is the participation of the Engineers Joint Council, Inc, and the American Chemical Society as "friends of the court" on Spevack's side of the controversy.

But neither the Government nor the private inventor may get a set of yardsticks as a result of the Spevack case. Interest all along has centered on the expectation that the case would clarify both the Government and the inventor's rights on inventions in the field of national security.

However, in two hours of oral arguments in the case before the Supreme Court, the nine justices broadly indicated they will handle the Spevack-AEC feud without ruling on the merits of either side's arguments. This would leave undecided the issues inventors had hoped would be decided by the case.

Basically, the controversy centered on AEC's right to publish previously classified information on the process of making heavy water in plants of the Atomic Energy Commission.

Spevack, claiming an invention of an improved process for isotope concentration used by AEC, sought to bar publication of the material by AEC on the grounds that such publication will destroy his rights to obtain foreign patents on his invention.

The case is complicated by secrecy . . .

imposed during litigation to protect Spevack's patent rights. He informed the AEC of his invention in 1949, and entered into a contract with AEC to show how it could be used in a heavy water plant. He reserved his rights to the invention and in 1950, filed a US patent application on the process.

Under the Atomic Energy Act, the patent application was classified under a "secrecy order." This prevents the inventor from disclosing his invention and, among other things, bars him from filing foreign patent applications.

In 1957, the AEC de-classified heavy water information and the secrecy orders on the Spevack patent applications were rescinded.

Spevack filed suit to block any AEC publication that would reveal the subject matter of his patent application. He argued the AEC obtained his process on a confidential basis, that the AEC did not own the patent application, and that the AEC had no right to publish anything without his consent that would endanger his foreign rights until he had had a chance to file abroad.

The AEC argued it was not publishing anything Spevack owned, but only material on heavy water which, under the Atomic Energy Act, it had a right and a duty to publish.

Lower courts upheld the AEC, saying Spevack could collect compensation for use of his invention and sue for any damages caused by AEC's publication of the information.

The nine justices peppered away . . .

at both sides with an unusual number of questions. Spevack's counsel got no further in his prepared statement of the case than the formal address, "May it please the court . . .", when the justices began.

They very soon established that the Patent Office had allowed Spevack's claimed invention, and that Spevack needs only to pay the $30 patent fee by May 25 to obtain full US rights to the process.

This was the first knowledge anyone other than Spevack and his lawyers had that the patent had been allowed—and it immediately put a new face on the case.

For as soon as Spevack pays his patent fee, the patent will be "published", thus destroying whatever remaining rights Spevack has in foreign countries whose laws prevent any prior publication. More important, as soon as Spevack gets his patent, the issue of whether AEC has the right to publish heavy water information disappears.

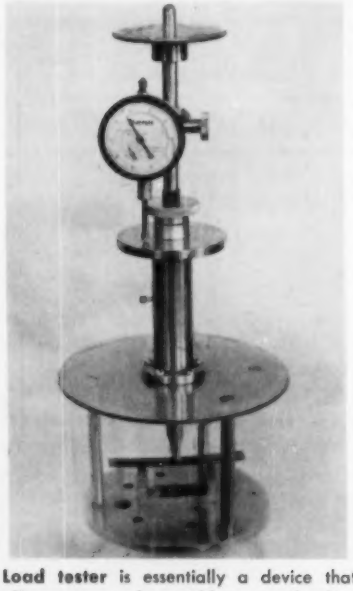
In fact, the Supreme Court implied it was being asked to decide vital issues of law in a case which will remain a real controversy only so long as Spevack does not pay his patent fee. In addition, Spevack has already had two years to file foreign patent applications since the suit began.

Spevack's lawyers still argued the lower court rulings set "dangerous precedents" unless reversed. But the Supreme Court rarely rules on a case if it can easily avoid it. It could do this in the Spevack case simply by waiting for May 25 to pass and then vacating the lower court rulings: thus, no precedent would be set—for or against inventors.

Low-cost load-tester for corrosion research

To study the effect of corrosive environments on the physical properties of materials, especially plastics, D. L. Hawke and R. P. Lee of National Lead Co.'s Titanium Div developed the inexpensive apparatus pictured here.

As they pointed out to last week's national meeting of the American Institute of Chemical Engineers: When evaluating the performance of plastics in corrosive environments, it's desirable to have information on changes in mechanical properties as well as in weight. Plastics under load in chemical environments ultimately fail at stress levels substantially below the short-term strength, even if the latter is measured after a period of soaking under no load. The mechanism of these failures seem analogous to stress-rupture or creep failures of the metals at elevated temperatures.



Load tester is essentially a device that allows measured, variable center loading of a horizontal sample beam supported at each end. Tester is designed to mount on 2500-ml battery jar which can serve as a container for the corrosive medium whose effects are being studied

The tester, built of standard components, and weighing only 8 lb, is designed to measure flexural offset yield strength and flexural modulus as the samples soak, under load, in the medium being studied.

New words

V: Ions and Radicals

Three terms that are "new" in their application, though old in point of time, are *molecule, ion* and *radical*. Here, as another installment of our glossary of science terms (for reference to earlier installments, see *PE—Nov* 17, '58, p 10) is a rundown of how these terms, and the units they describe, are being used:

Molecule is officially defined as "the smallest portion of an element or compound which maintains chemical identity with the substance in mass." It is a group of atoms, joined together by shared electrons. Break it apart, and these shared electrons are grabbed by some of the atoms, lost by others. Then, we may no longer have a molecule but, rather, several collections of atoms, some with more, and some with less than their usual number of electrons. These collections of atoms—charged molecular fragments—are known as *ions*.

Ions are taking on new importance today because they can be directed and controlled by means of electrical and magnetic fields. It is this which is opening the possibility of ion propulsion and hot-gas (plasma) nuclear reactors (*PE—Oct* 7 '57, p 15, and *Oct* 20 '58, p 10).

But not all molecular fragments exist as electrically charged particles. Some of these pieces of molecules are simply unstable atoms or groups of atoms. Yet even these are usually so anxious to combine with other atoms that, under normal conditions, they are only for a brief instant, "at liberty." For this reason they are known as **free radicals.**

The oxygen in a flame and the atomic groups that take part in many chemical reactions are free radicals. But most are "free" for so short a time that it has been difficult or impossible to capture them so they can be studied and put to work. Recently, though, cryogenics, the science of low temperature (*PE—Dec* 16 '57, p 12) has found a way. By chilling free radicals to the temperature of liquid helium as they are produced, they can be kept from recombining (*PE—Oct* 7 '57, p 15).

Now, scientists are talking of the possibility of using these fragments—in propulsion systems, for instance,—holding them in the free state until needed, and then taking advantage of the energy released when they recombine. Chances are, such propulsion systems are a long way off—but they are in the laboratories and in the news.

atom briefs . . .

Windows 5 ft thick and weighing 15,000 lb will be supplied by Pittsburgh Plate Glass for the AEC's new pyrometallurgical processing facility at Arco, Idaho. But, says PPG, they'd have to be even bigger if they did not incorporate a new design—an hour-glass shape that "retains maximum vision while reducing the amount of glass required for the 3-ft square viewing area of each window."

The facility itself rates close attention. It's designed to test new high-temperature separation techniques for reclaiming atomic fuels, should pave the way for application of the relatively new and important prometallurgical processes to other fields.

Reactor safety features will get a real workout as Argonne's Transient Reactor Test Facility swings into operation. The TREAT reactor, which went critical late last month, is believed able to produce transient pulses of nuclear energy of greater intensity than can be attained in any other facility. Design is flexible enough, too, to permit testing of a wide range of materials and components. —ARG

New resins: One up; one down

Booming interest in one new resin, polypropylene (*PE—Aug 11 '58, p 12*) has attracted still another supplier to the field; while booming production of another, caprolactam (raw material for nylon) is causing potential producers to stop, look, and listen.

New entry in polypropylene is AviSun, jointly owned by American Viscose and Sun Oil, and it's scheduled to be a fast starter. By taking advantage of existing facilities (leased from Koppers), it expects to be in production by mid-summer. AviSun has big plans for the future too: It expects to be the second largest producer (20 million lb/yr) of this new plastic by year's end, will be "an integrated company for the manufacture, processing and sale of resins, film, fibers ,elastomers, surface coatings, and adhesives using olefin polymers or copolymers with other substances."

As to caprolactam (*PE—Oct 22 '58, p 21*), Spencer Chemical and Industrial Rayon, which planned to build a $10-million caprolactam plant, now say that "entry of another large company into the field . . . will make it unnecessary and less attractive for us to proceed with plans to provide our own source of this material."

There's still plenty of interest in nylon made from coprolactam, though, and both companies are planning to continue their work in the field.

briefs . . .

Open-celled urethane foam serves as the air filter in Philco's new line of window air conditioners, Scott Paper Co reports. The foam, made by Scott, is claimed to "collect dirt from the inside out," loading in depth instead of just at the face. In addition, Scott points out, the foam is easy to install and can be washed with soap and water. Scott foresees its use in a wide range of pneumatic, air-moving, and air-cleaning equipment, and in liquid and gas detraining devices.

Spot-welded molybdenum can meet the specifications of MIL W 6858A, says T. R. Finn and Co Inc of Hawthorne, NJ. With new techniques, it is possible to hold the heat-affected zone to less than half of the original sheet thickness (0.010 to 0.062 in.) so the remaining material retains most of its tensile properties and ductility. The confined heat also minimizes contamination from the welding electrodes.

Improved inks for printed circuits have been developed at Naval Research Laboratory. Several systems, notably one based on vinyl resins, seem able to meet tighter specifications on adhesion, toughness and chemical resistance without sacrificing ease of application by the silk screen process. But laboratory researchers feel that inks alone can't solve these problems. Says NRL: "The quality of the screen to which the circuit design is to be applied and the method of etching seem to have much more influence on the quality of the resulting printed circuit than the chemical and physical characteristics of the ink." A complete report on the study is due soon.

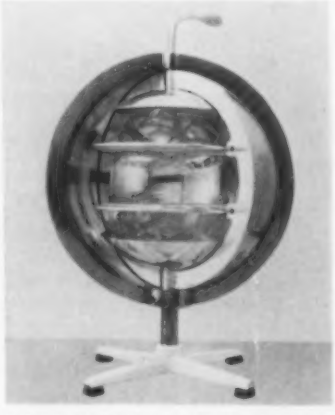
Highest strength-weight ratio ever achieved is claimed by Aerojet-General for a new group of structural plastics it has developed. Details are still classified; but Aerojet says their high strength stems from application of filament-winding and metal-to-metal bonding techniques not previously applied to plastics.

Noise-reduction coefficients of common materials and acceptable sound levels for various industrial areas are among the useful figures listed on a new slide-rule calculator prepared by the Propellair Div, Robbins & Myers Inc, Springfield, Ohio. The calculator itself is specifically designed for fan users and features the new "sone" ratings for noise level acceptability. It's obtainable from the company on letterhead request.

Extruded plastic film that offers transparency, toughness, and ease of processing, and is said to be first of its type to meet Food & Drug Administration specifications, is announced by Goodyear Tire & Rubber Co. It's plasticized polyvinyl chloride, flexible, heat-sealable, and sunlight-resistant, that's offered in the 1 mil thickness at 73¢/lb. One pound, says Goodyear, has a yield of 21,500 sq in. —ARG

Oven of the future?

No one's placing any bets, but this is one of the designs developed for Alcoa's *Forecast* program of designs-in-aluminum for the homes of tomorrow. A fully portable unit that could be used for preparation, warming and holding of food, it might be powered by a conventional electrical resistance heater—or perhaps someday by ultrasonic or solar energy. The body (two spun hemispheres), base, and handle are aluminum, and could be produced by conventional methods; and Alcoa engineers feel that the spherical shape, far from being a design gimmick, offers definite heating advantages and convenience in use.



Spherical oven, made of aluminum, features sliding hemispheres, opened and closed by lever at top.

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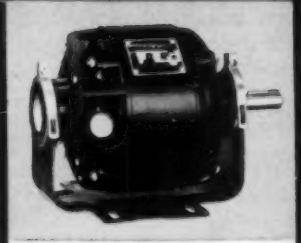

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Product Engineering HORIZONS

March 23, 1959

FREEDOM
and the uncommon man

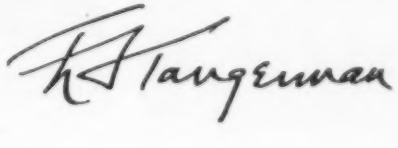
Some months ago, I was one of several speakers at a convention of technical writers. One of the other speakers, supposedly discussing semantics and its importance, launched instead into a eulogy of the American economic system, as his organization pictures it. He was careful to interpret or explain his more involved terms. But when he had finished, a young lady in the audience asked him to define one of his most-commonly used terms, the word "freedom."

He squirmed, he quibbled, he orated—but he never did define it. I'm rather sure she knew he couldn't—or wouldn't—because a proper definition would have knocked holes in his whole argument. Complete freedom, "the absence of restraints and abridgements upon private determinations, is available only to hermits," says Crawford H. Greenewalt in his new book *The Uncommon Man* (McGraw-Hill, $4). Mr. Greenewalt, president of duPont, points out that even Robinson Crusoe found it necessary, when his Man Friday showed up, to accommodate himself to changes of routine "occasioned by the existence of a second individual," as Daniel Defoe put it.

All of us—except hermits—must surrender some part of our independence as the price of admission to harmonious human relationships in modern society. The more closely we join with others, the greater the surrender is likely to be. We accept certain restraints for the good of the group, even in the close and often arbitrary confines of the family circle. Thus "freedom" is a relative term; we have less of it than our forefathers did because of the developments of our civilization, the limitations placed upon the individual by requirements of public health and safety, automobiles, aircraft, national defense and a host of others. But we still have much more of it than do people in the densely populated or over-governed other areas of our modern world.

Our conformity in social relationships, if kept to the essential minimum, is relatively harmless. The danger lies, however, in **conformity of thought**—submerging the individual's ideas and personality in an amorphous composite, as has been done in totalitarian countries and companies. As Mr. Greenewalt puts it: "Unfortunately people have come in modern times to mistake one for the other [personal for social]. There is a strong body of opinion that the conformist is the boy who gets ahead. School boys are now given grades on their 'ability to cooperate,' presumably on the theory that this will advance their fortunes once they launch their careers . . ." There are also the stories that successful men read, play, talk and dress similarly, that companies screen executives' wives, and so on. If this exists—and, contrary to general opinion, it's more likely in small companies than in large—it is a safe bet that the **individual** in that organization will be submerged, lost, overlooked. **So will the idea.** Every company is "the lengthened shadow of one man," but the other men in it should not stand in that shadow. If everybody does it the boss' way, there are breakers ahead.

The important thing in any organization is that each individual be given the opportunity to exploit his talents to the fullest, and in the way best suited to his own personality. He must not be muzzled by tradition and "policy." He must also be provided with the incentives that will excite his interest, extract his ideas, and direct them to the company's benefit. He must in other words, be managed as little as possible, given the freedom that can make us all uncommon men.

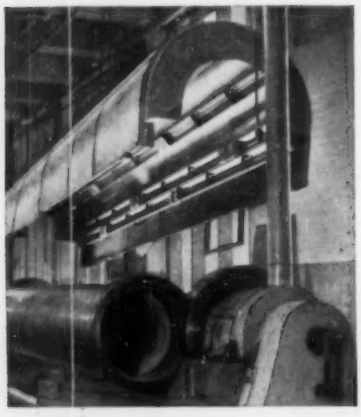


HOW CHROMALOX ELECTRIC HEAT helps make it... and make it work

...the U.S. Navy's new Mark 32 fibre-glass torpedo launcher

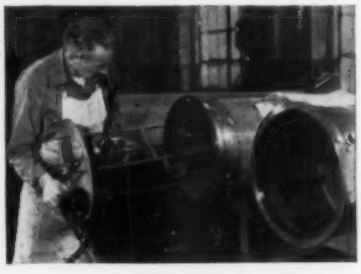
From its unlikely beginning as a fibre-glass mat . . . to its successful operation in sub-freezing sea spray . . . the Mark 32 torpedo launcher testifies to the versatility and dependability of Chromalox electric heat. Designed and built by Apex Reinforced Plastics, division of White Sewing Machine Corp., this lightweight, corrosion-resistant launcher is now in service on Navy destroyer escorts.

In early production stages, a Chromalox-heated hood is used in centrifugal molding of the launcher tubes.



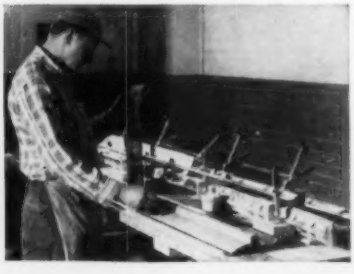
First, a rolled fibre-glass mat is placed inside the mandrel, which is then engaged in spinning motion at 800 rpm. After thermosetting resin has been sprayed into the mandrel, the hood is lowered into position for heat curing. The Chromalox type RAD Far-Infrared Heaters have a total capacity of 36,600 watts, and reach approximately 200°F. in about 45 minutes. The hood remains on a total of about 3½ hours, throughout the spinning operation.

Before final assembly, each tube must have steel "nut bars" and "guide bars" cemented to its interior. (Nut bars connect the three tubes into one assembly; guide bars guide torpedoes into each launcher tube.) After these parts have been cemented in place, two Chromalox Tubular Heaters wired in series are used to set the cement.



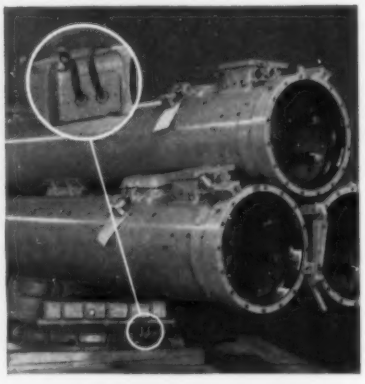
Mounted in a frame which holds them in the center of the tube for its entire length, the 240-volt, 2750-watt heaters are controlled by a Chromalox type AR Thermostat. A small fan attached to the end cap circulates heat within the tube and eliminates condensation during the drying operation.

Next, four plastic quadrants are bolted to the tube interior, forming a liner to accommodate 12¾-inch torpedoes. To each quadrant are affixed two 101-inch Chromalox Flexible Woven Heaters shown below being cemented



in place. After resin has been applied to the two channels in each quadrant, heaters are laid in place. The leads are then connected to a power outlet and the heaters set the cement which bonds them in place. In action, these heaters maintain a protective 50°F. minimum temperature for the torpedo.

The closeup below shows two leads of a circular Chromalox Tubular Heater clamped in a groove around the launcher's swivel base. To prevent formation of ice in the joint between fixed and rotating parts of the base, this heater comes on automatically when the temperature drops below 50°F.



Perhaps one of these heaters, or one of the 15,000 other types, sizes and ratings of Chromalox Heaters can answer your need for heat. For personal assistance and specific recommendations, *call your Chromalox Man for the Answers.* He's listed below.

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Baltimore, Md. HOpkins 7-3280
Binghamton, N. Y. RA 4-7703
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Boston, Mass. LIberty 2-1941
Buffalo, N. Y. SUmmer 4000
Charlotte, N. C. EDison 4-4244 FRanklin 5-1044
Chattanooga, Tenn. AMherst 5-3862
Chicago, Ill. HArrison 7-5464
Cincinnati, Ohio TRinity 1-0605
Clearwater, Fla. Phone 3-7706
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Recovery from Space

Northrop paradynamic engineers Tom Beresford and Bill Freeman report on progress and prospects for designing equipment that will bring first manned satellite to a safe landing back on earth.

VAN NUYS, CALIF—Years of experience in development of human escape systems and recovery of target aircraft will give designers charged with the assignment of bringing man-in-space safely back to earth a valuable headstart. This is the opinion of Tom Beresford, paradynamics group leader of Radioplane Div, Northrop Aircraft Corp, who expects that within two years, the world's first man-carrying satellite will be blasted into orbit.

Experience of Beresford's Paradynamics group already includes the landing-roll chutes for the B-47 and B-52, the A3D deceleration chute, recovery systems for the *Terrier*, the *Green Quail*, and the *Atlas* nose cone, plus part of the pilot's escape system for the Convair F-106. These have led to development of the *Rotafoil* (equipment recovery) and *Skysail* (personnel) chutes which will withstand the shock of high-speed deployment. Paradynamics has also worked on a capsule system to be used in picking up stranded pilots, and has developed impact-cushioning devices.

"Critical problems are to be solved before we can recover a man from an orbiting satellite," Beresford explains. "There will have to be extensive high-altitude windtunnel tests by engineers designing the capsule itself to be sure that they can bring a man safely through the heat barrier. Not many facilities are available for duplicating the speed and altitude conditions that will be encountered—a lot of this work may have to be done at NASA's tunnel in Cleveland. It will be necessary to determine that they can position the vehicle accurately enough—by ground-actuated retro-rockets or other means—to control the area where the landing will take place. Aeromedical teams will want to get the occupant as quickly as possible, and a landing in an inaccessible area could jeopardize the entire project. The attitude of the vehicle is of great importance too; and even though we've done a lot of high-altitude recovery work, a lot of tests will have to be made to find out the best height."

Bill Freeman, Paradynamics' top project manager, reports, "Available data indicate that the maximum altitude at which to start using recovery apparatus based on air resistance—parachutes, for instance—is 100,000 to 150,000 ft. Higher than that, there's not enough air density for them to work."

"The height that will probably be best for them to institute recovery will be from 70,000 to 100,000 ft," agreed Beresford. "At this height, it should be possible to loose a drag device—something like a sea anchor—that will slow the capsule down and also position it." He said an answer to the problem of a cloth that will withstand aerodynamic heating without losing strength may be found in high-purity quartz fibers with which his group is now experimenting. Woven into cloth, this refined relative of glass fiber is smooth, almost greasy, can be held directly in a flame without burning, melting or losing shape. He believes the best final chute for the system will be the new Skysail, currently being tested by the Navy for personnel flying high-speed aircraft.

He and Freeman explain that bringing the capsule in for a soft landing after it has safely descended into denser air is a familiar job for Para-

Bring 'em back alive . . .
Tom Beresford, right, charts possibilities for men to survive first flight into space. Company is working on the recovery system for Project Mercury, NASA space capsule.

Spaceman's chute? . . .
Designed by Northrop's Radioplane Div, this Skysail parachute is equipped with a series of rings with crescent-shaped slots for reducing shock loads, providing a safe means of escape during high-speed emergency bailouts. A variation in design is being considered for a means of recovery of the first man-carrying missile.

Less bounce . . .
is experienced on landing impact with this air-bag developed by Northrop. When parachutes are deployed, a small electric squirrel-cage blower inflates bag to 0.5 psi more than outside air pressure.

dynamics and for the equipment they have developed. Although every effort will have been made to protect the man in the capsule from shocks as a result of sudden changes in its position or from fast deceleration, they believe that the recovery system should be completely automatic. This is safer, does not require special extra training, and follows already proved systems.

For instituting the recovery sequence, they believe that their standard target-drone practice is best. A barometric switch closes a contact when the predetermined altitude is reached. This fires an explosive charge, which ejects the first recovery device. The barometric switch also energizes a group of time-delay relays, set to close after different time intervals, which actuate in sequence the remaining components of the recovery system. Standard practice for many jobs has been to double the control components so that two units—already having very high reliability—would have to fail simultaneously to result in a system malfunction.

EXPLAIN "VOTING SYSTEM"

"Now," says Freeman, "we work with a 'voting system' to give even-higher reliability. While doubling up does decrease the possibility that an important step in the sequence will fail to take place, it actually increases the chances of premature actuation. On a job involving high speeds or high altitudes, we must allow enough time for each of the drag devices to take effect, to slow down the vehicle enough to avoid too much shock on the next piece of recovery apparatus, or on the vehicle itself."

In the "voting system", three units are used instead of one or two, and two of the three must operate to be effective. For example, three barometric switches might be set to institute recovery at 75,000 ft. If one of the switches closed prematurely at 100,000 ft, this would only serve to actuate the system when one of the other two switches also closed. Wiring from each switch to the actuating unit is individual. Because the actuating units are generally explosive squibs, duplication is not considered necessary. Or, as Beresford puts it, "That's the safest part of the whole system. If there's one thing we do know by now, it's that a charge will go off when you apply power to the ignition wires.

"However, failure of one of the components in a system is infrequent," Beresford says, "We watch mostly for mistakes that people make putting the system together. For example, you can't spot a cold solder joint just by looking at it. But as soon as shock and vibration is applied, maybe you have no joint at all, or perhaps you have a system failure. We try to design this out by using two or three separate wires instead of common connections. All of our people—engineering, assembly and test—know that if there's any one secret to building good recovery systems, it's giving infinite attention to details."

Taking a circuit board out of one of his desk drawers, Beresford described it as a sample of the resulting hardware. On the bottom, an intricate silver pattern consisted of printed circuits to minimize the number of connections. On the top were barometric switches and a group of hermetically sealed time-delay relays and other electronic components, neatly arranged but with no attempt at miniaturization. Outside-purchase items were stamped to indicate they had been tested and accepted by Radioplane's own quality-control group. He also produced squib-actuated harness-release fittings in several different sizes. These are actuated by an inertia switch to release the chute harness and prevent the vehicle from being dragged when it hits.

From another drawer, Beresford produced a large chart listing all of Paradynamics' standard systems to illustrate his earlier contention that off-the-shelf hardware will ease the task of the space-capsule designers.

IMPACT ABSORBER

What the best type of final impact-absorbing device will be is an open question, but Paradynamics has two ideas; (1) as the capsule is expected to impact at a speed of 20 to 30 fps, the proper sort of cushion is important to protect the man and equipment. Approaching off-the-shelf status is radially expanded paper honeycomb which is applied in book-like sections. Prior to impact, the "covers" of the "book" are opened so that the honeycomb fans out, offering progressive resistance to crushing on impact. In one full-scale test, eight honeycomb decelerators on an 8500-lb test platform impacting at 30 fps kept the shock within 10 g.

Full-scale tests have also been conducted with an unusual type of air-bag, to overcome the "bounce" characteristics of the conventional type. When the parachutes are deployed, a small electric squirrel-cage blower inflates the bag to 0.5 psi more than outside air pressure. Around the periphery of this doughnut-shaped bag are a number of inward-pointing fabric nozzles with elastic rings constricting their ends. Burst diaphragms hold

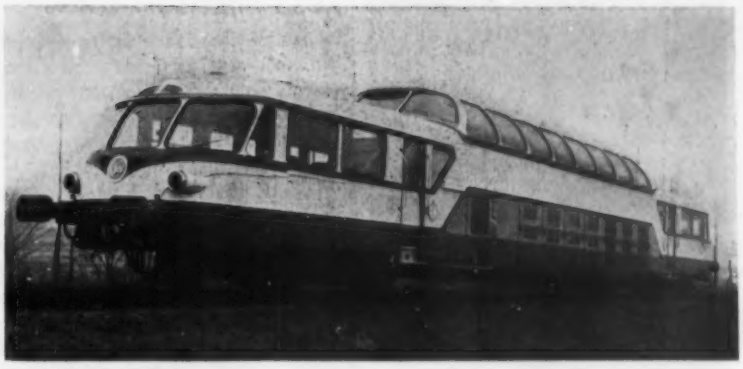
Design for listening . . .
This radar reflector by the Narmco Manufacturing Co, La Mesa, Calif, is constructed of concentric rings of lighweight honeycomb sandwich structures supported by prestressed tension truss rods. Such a backup can support a reflector 450 ft in dia. Company sources attribute several advantages to the design. Prestressed construction produces low deflection under loading and high resonance—from 15 cps up. With high resonant frequency, functional and mechanical breakdown of servo-mechanisms and other radar components is reduced. Because of lightweight construction, inertial loads induced by acceleration and deceleration are held relatively low, and the reflector surface will more readily hold contour tolerances essential for detecting high microwave frequencies.

the pressure during the drop, but burst on impact. Internal air pressure drives the nozzles out, and the elastic sphincters throttle the flow of escaping air to spread the shock over a longer time interval.

Also available on an off-the-shelf basis is the equipment for the final step in the operation—the shark repellant, dye marker and sofar (sound-wave producing) bombs for use in case of a water landing, the rescue radio beacon, flares, smoke signals and other pyrotechnics to guide rescuers to the site and to celebrate the return to earth of the first man in space.

Develop Method to Test Resistor Noise Quality

WASHINGTON—A method to evaluate the noise quality of fixed composition resistors has been developed by the National Bureau of Standards for the Navy Bureau of Ships. Noise quality is determined by measuring the increase in the mean fluctuation voltage at the terminals of a sample resistor when direct current is passed through the resistor. Two meters in the test set, one indicating average noise and the other the applied dc power, can be read in decibels for readily computing an index of noise quality or conversion gain.



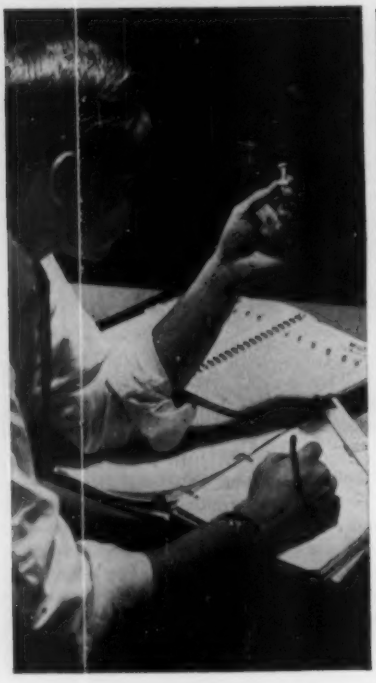
French locomotive . . .
with passenger accommodations has major body components of glass-reinforced polyester. Built by Renault, it marks the first extensive use of plastics in France for the construction of railway equipment. The result is a considerable weight saving despite the unusually heavy power plant. Reinforced plastic is used for the dome over the upper passenger compartment (except the windows), the body shells at either end, fuel and water tanks, stairways to the upper compartment, and ventilation ducts. Most of its 64 tons is in the 800-hp diesel-electric power unit necessary for hauling additional cars on mountainous routes. It carries 88 passengers at speeds up to 80 mph. First-class passengers ride in the upper compartment over the motor at the center of the car. The new panoramic Autorail is slated to go into service this summer.

Aluminum Replaces Copper in Large Motor

VIENNA—An East German firm is now making the squirrel cage of large motors from aluminum instead of copper. Such cages are possible, says the Vienna trade publication, *Der Osthandel*, because of a welding technique developed by Veb-Sachsen Werke of Neidersedlitz in which an aluminum short-circuit rotor axle is welded to the squirrel cage while the vertically suspended rotor revolves around its axle. Aluminum placed at the rotating shaft welds the two parts at 400 C.

The technique is said to have been applied to 16 motors ranging from 200 to 500-kw capacity. Extended tests have shown that aluminum did not decrease the durability of the rotor and cage unit. However, it did not decrease the manufacturing cost.

Furnaceless brazing . . .
described in last week's issue of PE, p 19 is pictured here in the form of the welded box in which a honeycomb sandwich is heated. This is made from sheet steel and has argon supply and vacuum connections. One of the coarse high temperature silicon fiber blankets, stapled together with the mesh heating unit in between the two layers of fabric is shown under the box. It has to be carefully controlled so that gases produced by the brazing compound are removed without generating internal pressure which would lift the skin away from the cone, and prevent a good bond from being formed. Rohr hopes to eliminate the sealed-box system as soon as blanket graduates from R & D stage (right) where experimental braze was made with temperatures of about 1800 F. This system would eliminate the construction of huge brazing furnaces for each fabrication job. Test thermocouples are spot-welded to the steel box.



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Find Radiation Belt Less Intense

Moscow—Russian scientists report that data received from their cosmic rocket show that radiation in belts around earth is less intense than originally presumed. Manned spaceships, therefore, will require relatively less shielding than had been expected, they said.

According to S. Vernov, member of the USSR Academy of Sciences, and A. Chudakov, a large number of electrons are circling the earth at altitudes up to 31,250 miles, but their energy is relatively small, ranging from 30,000 electronvolts to 100,000. Cosmic radiation intensity at great distances from earth is "negligible" with only two particles passing through one sq cm every second. At distances exceeding nine earth radii, intensity does not change as distance grows between space vehicle and earth.

The Soviets report that the space rocket proved experimentally that electrons moving around the earth waver in their motion wandering for a very long time while locked in a magnetic trap created near the earth by the earth's magnetic field. At a height of 9,400 miles there are 700 times more particles than at height of 250 miles on the same line of force. The Soviets said, "This means that of the 700 particles at 9,400 miles only one flies down to low altitude; the other 699 waver along the line of force going from one hemisphere to another and back and do not fly down to low altitude."

The two Russian scientists went on to say that there are grounds for presuming that the inner zone of intensive radiation around the earth consists mainly of protons. However, no details were given. Electrons of the outer zone possess energies which are relatively small.

US to Dominate Paris Computer Conference

San Francisco—As final plans are being made for the forthcoming global computer conference sponsored by the United Nations in Paris this June, the strong world-wide position of US computer technology has been confirmed. The formal program alone will feature 23 of 55 papers from computer experts in the US, it was announced at the recent Joint Computer

New G-E silicone rubber cures at room temperature

General Electric's new RTV (room temperature vulcanizing) rubber cures in any time you select up to 48 hours. It resists heat up to 600°F and has excellent electrical properties. Among its present uses are:

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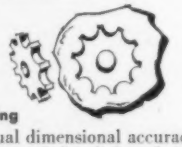

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Conference in San Francisco.

Honorary Chairman of the International Conference will be Prof Howard Aiken of the Harvard University Computation Lab. An Honorary Vice Chairman will be Dr John W. Mauchly of Sperry Rand Corp.

Of the 13 major symposia now included in the final program, US computer people will act as co-ordinators of six of these. A special new session added to the formal program will explore "Computer Techniques of the Future."

Prof Aiken also said that central computer systems will go out of date in the next decade. Prof Aiken is credited with making the original theoretical approach to the electronic digital computer more than ten years ago.

Prof Aiken believes that computers can get smaller by a factor of up to 100,000. This will cut the installation cost to the point where anyone who needs a computer can have it, making the great central computers obsolete.

He noted also that computer sciences are becoming highly inter-disciplinary. Use of computers in management, language translation, and even music composition has in its very nature taken the computer scientists out of mere calculating.

ICI Members Research for Each Other

CHICAGO—Members of the Investment Casting Institute will get thousands of dollars of research information on investment casting technology through that trade association's new Cooperative Technical Research Program. Through this program each member of the Institute will contribute one research study and in return will receive a completed study from each of the other members.

An ICI Research Committee and the ICI members have developed a listing of research projects of interest to manufacturers of investment castings. This list is then circulated to the members with the instruction that they pick one or more projects for their contribution during the year. The members may select one of the projects recommended by the Research Committee, or they may propose another study which they feel would be of value.

As a result of this program, which was set up during the annual meeting

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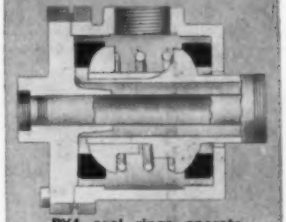

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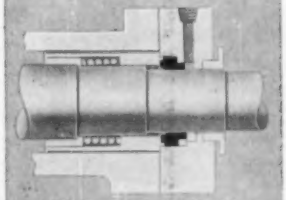

Mechanical seals with Morganite PY4 noses provide an extra measure of dependability in this stuffing box assembly.

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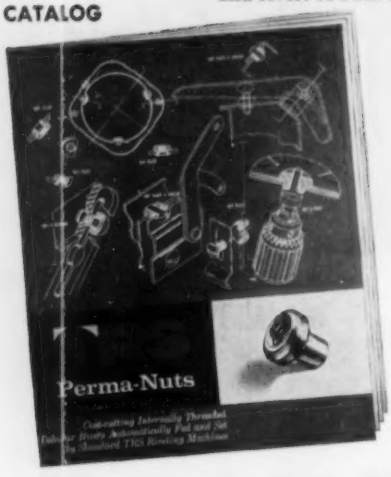

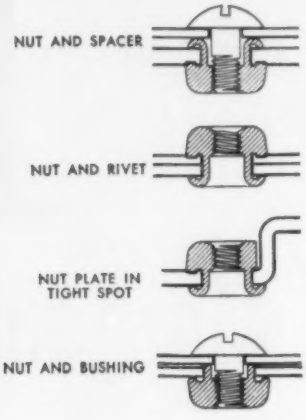

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last November, three research projects have already been distributed to ICI members. Two, of interest to designers, are: "The Effect of Aging Time and Temperature on the Mechanical Properties of 17-4PH," by F. K. Iverson of Cannon-Muskegon Corp; and a study of the "Properties in AISI 410," by W. F. Carn of Precision Metalsmiths, Inc.

Transistors Correct Telex Signals

BONN—A new radio telex installation with automatic "error-correction system" has been developed by Siemens. It is claimed as the first to use a circuit of transistors and rectifiers instead of the conventional electromechanical parts such as relays, rotating distributors with sliding contacts or cam switches, and tubes.

The error-correction system has the "Sevener-Code," ie, an alphabet with seven code signs per letter which reduces the error rate to 1 : 50,000 compared to 1 : 1,000 in the "Fiver-Code." Impulses received by the normal "Fiver-Code" are transposed into the CCIT #3 "Sevener-Code" by a crossbar circuit consisting of rectifiers.

Duplex radio connection facilitates automatic backqueries by RQ signals on receipt of "wrong" signals. The RQ signal blocks transmission and starts a repeat cycle: Code stores at the transmitting station then send the queried signal plus the two following signals again before normal transmission is resumed. The code stores are necessary because in intercontinental transmission the time lapse between arrival of a wrong signal and its repeat may amount to 400-500 milliseconds. Storage units of the Siemens-Elmux have transistor sweep circuits.

Low-cost Automatic Transmission for British Cars

LONDON—A leading British car manufacturer will fit a cheap, unconventional fully automatic transmission as standard equipment on most of its car types this year, according to reports. The transmission uses two magnetic-powder clutches with a conventional gear box. The company—Rootes Ltd—had developed the transmission in conjunction with Smith Motor Accessories, Ltd. The clutch will be fitted initially to engines having between 1.2 and 1.7 liters displacement.

The company claims that the transmission is the cheapest fully automatic system yet developed and costs only slightly more than manual shifts.

Redesign Transmission Housing

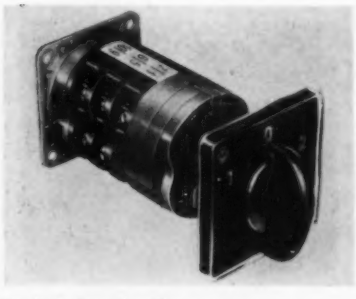
DETROIT—GM's Detroit Transmission Div has redesigned Hydra-matic transmission housings to spread out laterally, thus reducing the hump in the front seat. The housings also will be designed so that the car divisions, when ready, can move the transmission to the rear to form the trans-axle.

Plastic Innards Fashioned for Electric Switch

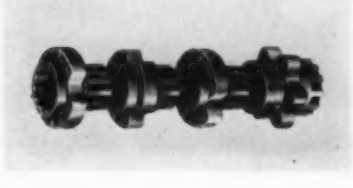
VIENNA—A rotary switch, made entirely of plastic except for contact points, springs and terminal screws has been developed here by Kraus & Naimer. Designed for instrument and control panels, the switch has a plastic center shaft that eliminates current leakage paths normally present with metal shafts.

The shaft is a series of couplings with splined hubs and a cylindrical section into which the coupling bolt is fitted. Cams are molded integral with the coupling.

The standard switch is a three-stage unit that can be enlarged to 12 stages. If a wiring system requires more than 12 stages, the assembly can be fitted with a tandem drive for a second stock.



Switch to plastics . . . eliminates need for grounding in Austrian-made rotary switch. Shown is basic C-16 model (top) and (below) plastic couplings that replace the metal center shafts.



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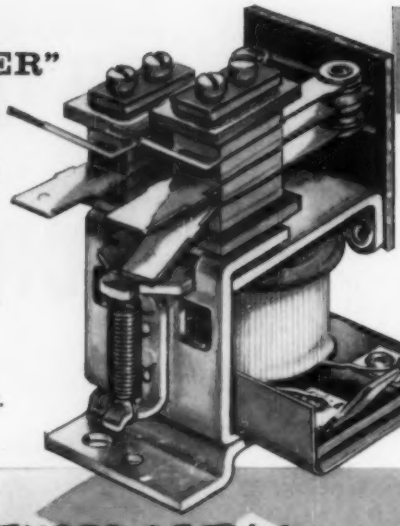

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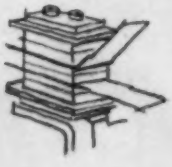

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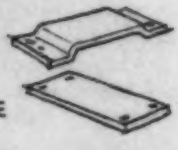

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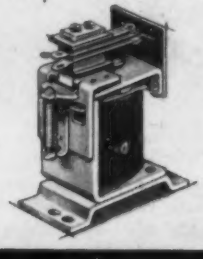
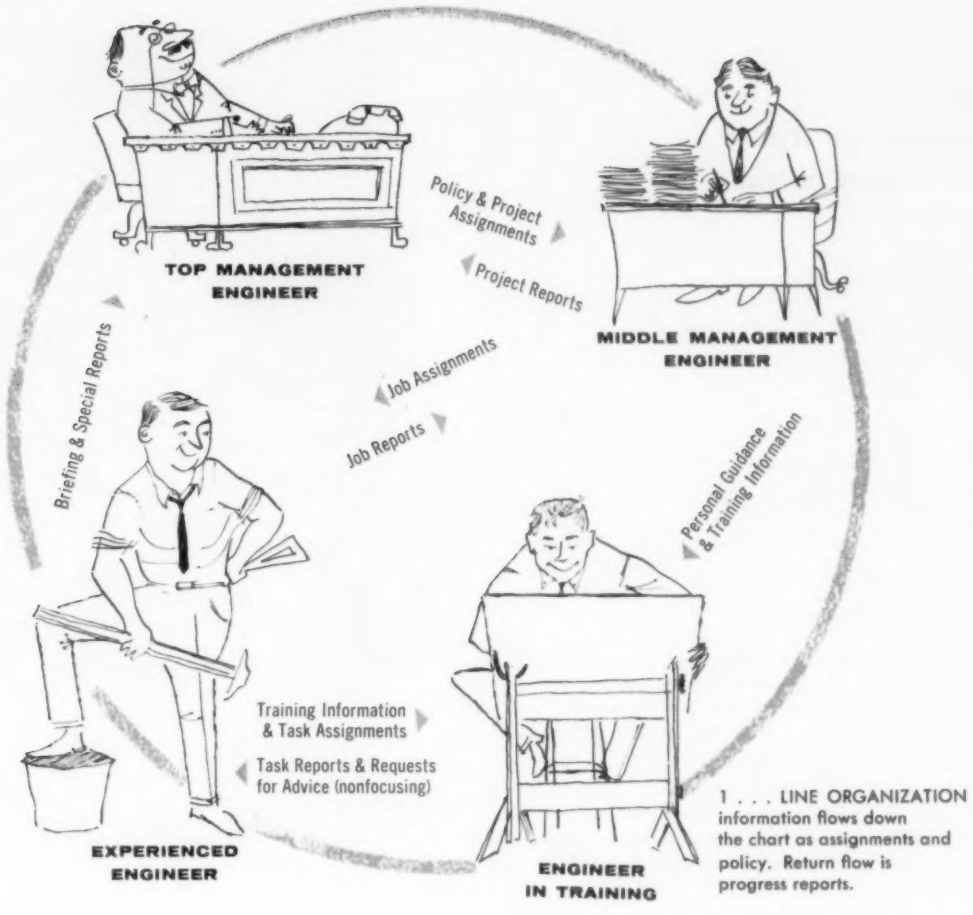


Consult Your Local RBM Product Application Engineer or Write For Bulletin 1060

RBM Controls Division

ESSEX WIRE CORPORATION, LOGANSPORT, INDIANA


TOP MANAGEMENT ENGINEER
Policy & Project Assignments
Project Reports
MIDDLE MANAGEMENT ENGINEER
Briefing & Special Reports
Job Assignments
Job Reports
Personal Guidance & Training Information
Training Information & Task Assignments
Task Reports & Requests for Advice (nonfocusing)
EXPERIENCED ENGINEER
ENGINEER IN TRAINING
1 . . . LINE ORGANIZATION information flows down the chart as assignments and policy. Return flow is progress reports.

who needs to know...and what

What you say in engineering progress reports and assignments may make the difference between time wasted and project success.

W M TERRY
Director, Engineering Coordination
Allis-Chalmers Mfg Co

■ How do you pass on new project assignments to your technical group? Do you simply break up a project into parts and then distribute them? Or perhaps you outline the job assignment without indicating limitations or policy background so that your assistant will attack the problem "without preconceived notions."

Well, a group leader contributes nothing—not even administration—by just dividing up the project for his men. A secretary could do that. And if he is indefinite about background and limitations of a job or tosses in irrelevent information on the chance that someone will find a use for it, he is actively contributing to confusion. The company would be better off without him.

Still another type of boss tends to hold on to his incoming information and pass on only an irreducible minimum. This "log jamming" produces a high-pressure approach

who needs to know . . . and what

CONTINUED

2 . . . LINE AND STAFF organization includes a non-engineering manager who must be included in the information below

chosen by some in the interest of what they call efficiency. The pressure builds up and up, but nothing ever happens. The man down the line has no idea of what is expected or why he's doing what he is.

This is a plea for focusing flow. As information goes from man to man it should be progressively refined, ending finally in a needle point—the solution. The sharper the needle, the clearer and better the solution.

Flow paths

Information flows from and to every man on the staff. The kind of information depends on the man's position in the organization. For example, the engineering line organization (Fig. 1) is made up of:

a top management engineer responsible for engineering policy and top administrative decisions. His title is vice-president of engineering, director of engineering or the like. On the next level

the supervisory or middle management engineer has primary project responsibility in administrative areas. The chief engineer of a department might have almost exclusive administrative responsibility for his department and the technical project being pursued. He is also a policy adviser and project superintendent to the

experienced technical engineer who has few administrative responsibilities but who heads the engineering team. His technical background and know-how are used directly to solve problems. In smaller companies the middle management and technical engineering duties tend to merge into one man's responsibility. At the bottom and working with careful supervision is

the engineer in training. He may be a recent graduate or an engineer with the company for a relatively short time.

Policy and project assignments flow from the top management to the middle management engineer and then to the experienced technical engineer. Progress reports flow back up the chart through the middle management engineer or directly to the top management engineer in the form of briefing sessions or special reports.

The line and staff organization (Fig. 2) differs only in that an operating manager is added who uses policy and project recommendations made by the top management engineer in his over-all company decisions.

In all these flow paths, information flow must be focused —condensed and clarified so that each man makes a contribution to the solution, not to the quantity. Only in the flow between the engineer in training and his immediate superior is parallel (nonfocusing) flow to be expected. But even here one measure of the engineering maturity of a

What do their titles really mean?

The basic structure of an engineering organization calls for only four job functions—no matter what the title—and titles vary widely among different organizations. Can you find these functions in your setup?

Top Management Engineer	Middle Management Engineer	Experienced Engineer	Engineer in Training
Chief engineer	Project engineer	Designer	Mechanical engineer
Director of engineering	Works engineer	Design engineer	Engineer
Technical director	Industrial engineer	Product designer	Electrical engineer
Vice-president, engineering	Group leader	Research engineer	Junior engineer
Research director	Senior engineer	Development engineer	Laboratory engineer
Engineering manager	Section engineer	Product engineer	Assistant engineer
	Supervisory engineer	Tool engineer	
		Structural engineer	
		Machine designer	
		Methods engineer	

man is the change of his output from parallel to focusing flow.

Remember, engineers themselves will originate the most important data of all. Their reports and recommendations and designs are the only saleable products of the engineering department. Therefore, technical articles and talks by staff engineers serve a dual purpose. They increase the stature of the engineering staff in the eyes of the engineering community as well as do wonders for the personal and professional character of the individual.

Information handling

Written, internally produced communications include: standards; material, process and product specifications; manuals; research reports; standard parts lists; assignments; patent disclosures; cost studies; budgets and many others. The engineer must have this information to do his job and if the department is of any size at all rather formal procedures should be adopted to make sure the information is readily available, up-to-date and to the point.

Engineers have to do the compilation—preferably a standards engineer is appointed and made responsible for preparation and availability of the data and he, or a librarian, is also responsible for technical articles, catalogs, bulletins, magazines, reference books, and patents.

The chief engineer should not dump all this paper on the new man. He may assume that because the information comes from management he is expected to read and assimilate it all. Tell him what is available if he needs it, spell out his assignment carefully and precisely and then let him search out his own data.

What is offered should be complete and honest. For example, data on manufacturing or material costs are regarded by some comptrollers as top secret. As a result wrong design decisions are made. If necessary, assign an engineer to help Purchasing or Manufacturing get the data needed.

In a similar way, isolation of the technical man from customers and their problems may result in unrealistic designs. Most companies have sales and applications engineers acting as intermediaries between the customer with a problem and the engineer with the solution. The technical man can get a broader picture more quickly if he can participate in discussions with customer engineers. His interest is aroused, pride and reputation make him really work for an elegant solution, the customer's engineers appreciate the chance to speak directly to an "inside" man, and their opinion of the company is bound to be enhanced by contact with its top brains.

The same reasoning holds for exchanges between research and engineering departments within a single company. Formal technical reports do not transmit scientific discoveries as well as informal conversations do. The engineer has to be sold on change, especially radical change.

Vendors of raw materials or components have the problem of acquainting their customers' engineers with their own advanced development work and they need assistance in this. The vendor's engineers don't always know how a new material may be applied, for example, or what use an unfamiliar industry might make of a new component. Unfortunately, the vendor's salesman doesn't always help get engineers together. He is primarily interested in the sale of catalog items. Don't let the lack of advanced engineering information be your company's fault.

The basis rule is: **Don't isolate engineers.** It applies in technical areas, of course, but financial or policy recommendations are involved in the final decision as well. It is only fair to the engineer, no matter how far down the ladder, to know why his recommendations were ignored—especially if factors beyond his control. ■

TRENDS

in appearance design . . . HOW MUCH APPEARANCE

Remember what our outspoken panel of critics said about the '59 American cars? (PE—Dec 1 '58, pp 26-29). Montgomery Ferar was one of the industrial designers on that panel. He has also been speaking and writing on such topics as the one we invited him to discuss here. We sent him four questions as a guide . . . they, and his replies, appear below.

". . . all the basic dimensions were compromised to get a preconceived silhouette."

MONTGOMERY FERAR,
Sundberg-Ferar Inc, Royal Oak, Mich.

Illustrations by Sundberg-Ferar, Inc. staff.

1 Why is appearance design necessary to product development?

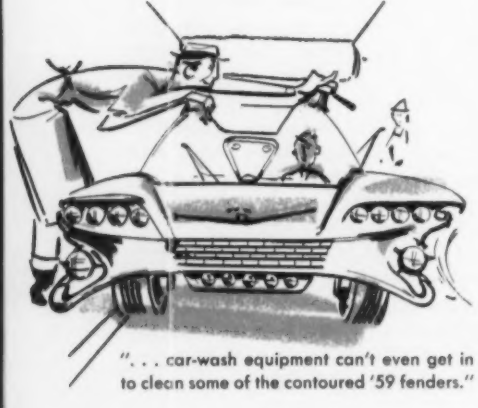
Industry in this country is increasingly concerned with the competition of foreign products imported from Italy, Germany, Austria, the Scandinavian countries, and Japan . . . particularly with those products involving much hand labor—like sewing machines, radios, photographic equipment, and even automobiles.

The engineering and production quality of these foreign imports has improved enormously in the last few years. For example, I had a talk with a machine-tool man on a plane recently—he told me many of the Russian machine tools exhibited at the Brussels Fair were **on a par with American machine tools.**

It is becoming increasingly apparent that American manufacturers will have to meet and beat this competition on other counts besides engineering and production quality. **Appearance design is one way of doing this**—many of these same manufacturers long ago discovered that improvements in appearance design can give one company's product decisive sales advantages over its competitors. This experience can certainly be applied to competitive products from abroad.

For one thing, the American public and the American design profession are both more sophisticated than their foreign counterparts in matters of mass-production design. American industry can and should take advantage of this fact to make its products superior in visual-functional aspects, and thereby attract more customers.

However, any competitive advantage that American manufacturers achieve by this route is certain to prove only temporary unless we obtain more design protection. Our courts have already established the fact that **an appearance design may be protected by patent, and that those who infringe can be sued for damages. Similar protection needs to be extended to American product designs against pirating by foreign producers.**



". . . car-wash equipment can't even get in to clean some of the contoured '59 fenders."

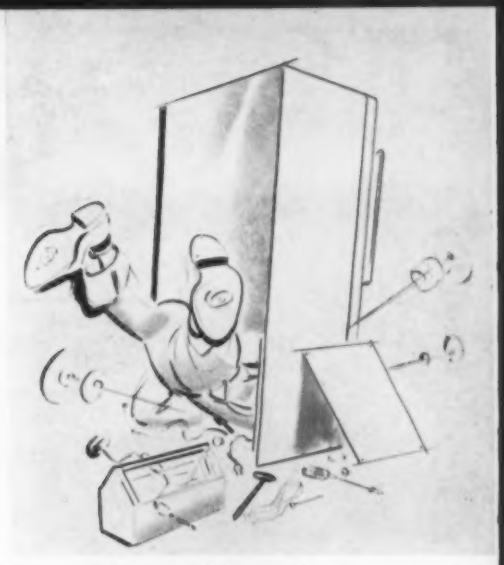
2 Is it possible for a product to have too much design?

Yes, if that design consists of mere decoration, without any function. For example, certain household appliances today are loaded down with ornament added merely for the sake of creating an atmosphere. Such ornamentation is generally hard to clean and often has no function. **Ornamentation can, however, be used to point up a control area, say, which may even need to be protected by chrome or some other hard-wearing material.**

3 What aspects of product development should the industrial designer be asked to participate in?

It's a good idea to invite the industrial designer to take part in any as-

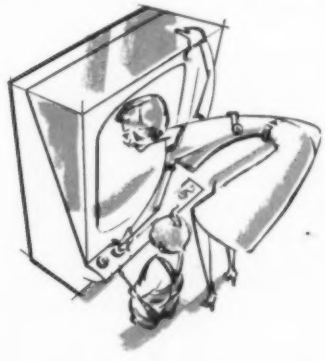
DESIGN DOES A PRODUCT NEED?



". . . service accessibility is of prime importance."

pect of product development that may influence the appearance of a product. **The designer should be consulted as early as possible**—he should have some say in the arrangement of components so they won't make an unnecessarily awkward and costly package for him to handle at a later stage. With computers, for instance, when we were called in early enough we found we could work out with the engineers component arrangements which lent themselves to more pleasing packaging possibilities and with no loss in engineering performance. Often, when they did the arranging on their own, there was at least a 50-50 chance the result would be less attractive and even less functional. After considerable engineering **is already done, it is generally costly to correct such situations.**

Human-engineering factors, such as size and arrangement of controls and display panels, color and lighting, also concern the industrial designer. He is, I believe, the proper agent to work with the human engineer, if the job calls for one. Otherwise, the industrial designer should *be* the human engineer for the project.



". . . size and arrangement of controls are also matters of concern to the industrial designer."

4 Can a product be overdesigned?

Design can be the tail that wags the dog. I'm thinking of some automobile styling, where all basic dimensions were compromised to get a preconceived silhouette that the designer had dreamed up, or to match what the sales executives thought would sell.

Result—a beautiful piece of sculpture, but not too useful as an automobile. The extreme sheetmetal shapes are more difficult to fabricate and to get in and out of. No body shop in the world can repair some of the deeply contoured '59 fenders, and some car-wash equipment can't even get in to clean them. Passengers are cramped. Safety factors (strength of doors and roof supports, for example) were neglected. There is less accessibility to the trunk for loading and to the engine for servicing. This, to my mind, is an example of overdesigning, and it represents a disservice to the consumer.

I don't think anything is good design if it's not functional.

As for appliances, the designer should be aware that **the increasing complexity of function of modern appliances means more service calls.** And not because of any decrease in the quality of the product, necessarily. It is more likely to stem from the increase in the number and complexity of components, any one of which can get out of order.

Therefore, service accessibility is of prime importance. If the front of the machine is loaded with meaningless trim that has to be removed for servicing, or if design requires the machine to be pulled out from the wall for servicing, that will take more service time—and be more costly for the owner. Service calls may even be avoidable if the adjustment area and those components requiring occasional replacement have been made easily accessible to the customer. ■

POINTS OF VIEW

THE QUESTION: ***Should the US Adopt the Metric System?***

BOYCE M ADAMS,
president, Wayne Kerr Corp,
Philadelphia

"Yes . . .

The US is presently using the metric system indirectly–in its monetary system; also, decimals are generally used in industry. The metric system would simplify subdividing, therefore such a basic international unit of measurement would be advisable. In mechanical measurement, distance is frequently expressed in mils, which is basically the metric system; we are using the metric system in part, so why not in toto?

"Metric system measurements would greatly aid international communications, since most of the major nations use this system. Technical people are trained in the metric system, a training that is much easier than fractions. An additional argument for universal use of metric measurement is that most electrical quantities are defined in terms of CGS and MKS units, which are all based upon the metric system."

"No . . .

H S SIZER
director of design
Machine Tol Div
Brown & Sharpe

The machine-tool industry has been flying in an inch-standard airplane and has passed the point of no return. It is conceivable that a metric plane might have been better, but the die was cast a long time ago and now, with our tremendous investments in drawings, tools and education, we are going to finish out the flight. We obsolete drawings, scrap tools, and rebuild our plants when estimated savings show that new equipment will pay for itself. No dreams of savings through the use of the metric system have ever matched the staggering costs of an inch-to-metric changeover.

"If the metric system ever does come in I expect it will come in with new industries which, because of their scientific origin or birth in a metric country, start off with a metric system".

"Having successfully converted our operations . . .

WILLIAM P CUSICK
director of quality control
Parke, Davis & Co

in the United States and Canada from the complex *avoirdupois* system of weights and measures to the metric system, we feel the adoption of this system by the US would be of benefit to all concerned. The switch-over would be of great advantage to the many American manufacturers who are expanding their operations in overseas areas. With the advent of newer foreign markets and faster transportation, more and more US firms are entering these overseas areas–areas where the metric system is the established form for weights and measures.

"Not only would the US businessman find it easier to operate in these foreign lands on the metric scale, but it would be good public relations to operate under the system in effect in these countries. This would eliminate much converting back and forth.

"Also, in a period when more and more attention is being paid to costs, the metric system provides a closer control on raw materials and the final product. The metric system offers an improved means of weighing, measuring, recording and accounting. And, any improvement is progress."

VIEW

"The National Bureau of Standards . . .

A V ASTIN, director
National Bureau of Standards

provides calibrations and technical measurement assistance in either, or both, English or metric units. The Bureau uses the kilogram and the meter, calibrated against the "International Standards" maintained at Sevres, France, as the national standards. English units are based upon a numerical relationship to these standards. As to whether the US should "adopt" the metric system, the Bureau will act upon the will of the Congress.

"The problem of shifting from English to metric system on a legal basis, in an advanced economy such as ours, would be a considerable and a complex one, requiring years of education, retooling, and reinvestment. We are, at present, very much interested in the studies of this problem being conducted by the British Association for the Advancement of Science and the American Association for the Advancement of Science. We are also interested in the program of Japan to shift to the metric system, especially in their plans and experiences. This will mark the first time that an industrially advanced nation has undertaken such a shift."

"The metric system owes its ubiquity . . .

H C CORBEN
associate director, Research Laboratory, Thompson Ramo Wooldridge Inc

to the way its radius of 10 allows it to mesh simply with the numbering system and, in many places, with the monetary system. The version of it based on the meter, kilogram and second also fits naturally with our electrical units of watts and volts. For many purposes it saves needless arithmetic, and it is not surprising that the US foot and pound have been defined for nearly 70 years in terms of the international meter and kilogram.

"It seems to me the difficulty of adopting the metric system into our daily lives would be formidable. All our instruments for measuring distance, velocity and mass would have to be recalibrated or rebuilt, whether they are yardsticks, precision gages, bathroom scales, speedometers, or surveying instruments. After all the inevitable confusion would remain the problem of relating future measurements to buildings and roads constructed in the old era. Even a new 3-foot window frame would be hard to buy after the changeover, unless for some reason people were still constructing them in odd sizes such as .9144 meters. What would be gained from adopting the metric system? A little less arithmetic eventually, but more confusion than the goal is worth."

"The recently announced agreement . . .

J R TOWNSEND
president
American Standards Assoc

among the National Physical Laboratories of the United States, the United Kingdom, Canada, New Zealand, Australia and South Africa on a conversion factor between the international yard and the meter and the international pound and the kilogram makes a decision as to whether or not the US should adopt the metric system unnecessary.

"For linear dimensions, the agreed ratio becomes 25.4 mm equals 1 inch—a ratio which has been in existence for industrial purposes since the approval in 1933 of American Standard Inch-millimeter Conversion for Industrial Use, B48.1-1933. This standard provides convenient conversion tables which can be prepared by any competent organization.

"With an established conversion factor there is no problem in conversion between metric and inch units. The widespread use of the metric system in scientific calculations will undoubtedly continue, but with the use of decimal fractions of the inch and the established conversion factor there appears to be no practical necessity for adopting the metric system for linear dimensions."

SIGNIFICANT COMPONENTS MATERIALS PROCESSES

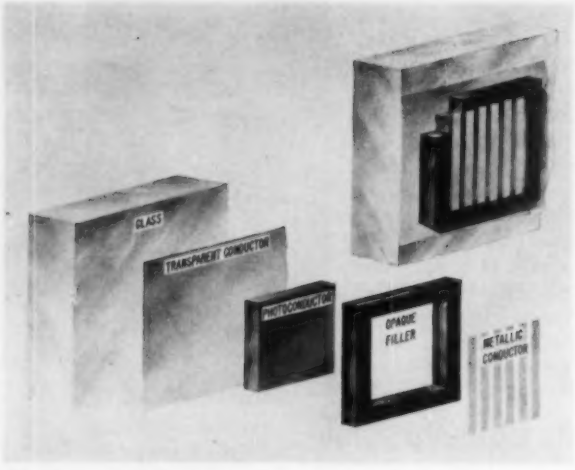


Photo rectifier assembly . . .
consists of sandwiched layers of glass, transparent ohmic conductor, sintered cadmium sulfide, top rectifying (or metallic) conductor. Under illumination through punched card, tape, film or other system, each cell in this device responds as a diode, in 100 millisec; rectification ratio is 1000:1. With light shut off, cell becomes an open circuit or linear resistance. Can be constructed in X-Y matrix system with up to 100 detectors per sq in.; densities in excess of 256 are being developed. For programming, switching, data storage, numerical display generation. Cell has forward resistance between 10,000 and 20,000 ohm. **Rex Corp, W Acton, Mass.**

Circle 11, Reader Service Card

Interlocked non-woven felt . . .
is made from synthetic fibers and is now available in commercial quantities in widths to 9 ft max, thicknesses to 1 in. max, with weights of 3 oz to 6 lb per yd and permeabilities of 10 to 200. Strength ranges up to 1500 psi, depending upon the fiber. May be used continuously at 400 F. Said to give better abrasion resistance than natural fiber felt, resistance to most acid and alkalis, and is not affected by moisture. Will not support rot, mildew, or bacteria growth. Uniformly smooth, felt may be die-cut without becoming ragged at edges. Also can be sewn. Felt is produced by a mechanical interlocking of fibers, rather than chemical binding agent or supporting fabric. Felts match SAE specs for weight and thickness. Prices, depending on fiber, start at ½¢ per sq yd and range to prices equal to the cost of F-1, F-5 and F-10 grades of natural fiber felts (for Dacron). Delivery, about 1 wk. **Troy Blanket Mills, 200 Madison Ave, NYC.**

Circle 12, Reader Service Card

Fire-safe mastic sealer . . .
is self-extinguishing after solvent has been released. Because it is also pumpable, it is suited to production-line installations. A variety of characteristics are possible to meet special application requirements. There are sealers, for example, that are fast or slow drying, odorless, capable of retaining sealing qualities while submerged in water, resistant to breakdown due to frequent freeze-thaw cycling, able to span open spaces and gaps up to ¼-in. without slumping, and of taking paint-baking temperatures without running out of place. About $1.40 per gal; delivery, 10 days. **Presstite-Keystone Engineering Products Co, Div American-Marietta Co, 39th and Chouteau Ave, St Louis 10.**

Circle 13, Reader Service Card

◀

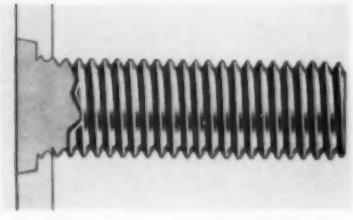
Pipe coupling for remote . . .
operation or for use in confined areas consists primarily of a conventional coupling to which a gear-and-pinion locking mechanism has been added. For use when there is no room to use a wrench—or operating conditions make it impossible for personnel to enter installation area. Pinion is removable from coupling, making unit tamperproof. May be power or hand-operated, by ratchet spanner, gear key or other means. Said to maintain proper seal at all times without being twisted out of shape, since tightening force operates throughout 360°. May be used with any standard sealing or joint face. Available in range of sizes. **Stanat Mfg Co Inc, Westbury, NY.**

Circle 14, Reader Service Card

Hydraulic-motor gear reducer . . .

consists of a gear-type fluid motor mounted as part of a planetary gear reducer. Reduction ratio of 4.6:1 is said to provide smooth output even at lowest shaft speeds. Components were designed to produce 150 ft-lb output torque when used with an oil source capable of 1500 psi. Unit mounts on SAE standard 4-bolt D size hydraulic-pump mount. Over-all dimensions are about 8 x 8 in. and unit projects about 7½ in. from mounting surface. Suitable for use in driving rotary soldering, welding or heat-treating fixtures; powering hoists, cranes or rope drives; turning turrets and platforms; driving elevators, conveyors or earth augers. **Webster Electric Co, Racine, Wis.**

Circle 15, Reader Service Card



Flush-mounting captive stud . . .

installs in panels of cold-rolled steel, brass, copper, aluminum alloys and similar materials from 0.040 in. thick and up. Self-clinching studs are dropped into punched or drilled holes and then squeezed into place by standard pneumatic, hydraulic or mechanical presses. Squeezing action embeds head projections of stud into panel. Displaced metal flows smoothly and evenly around back-tapered shank and annular groove, creating a flush head assembly and locking stud into panel. Made in steel and #305 stainless steel in thread sizes from #4-40 to ⅜-18, and in lengths from ¼ to 1½ in. **Penn Engineering & Mfg Corp, Doylestown, Penna.**

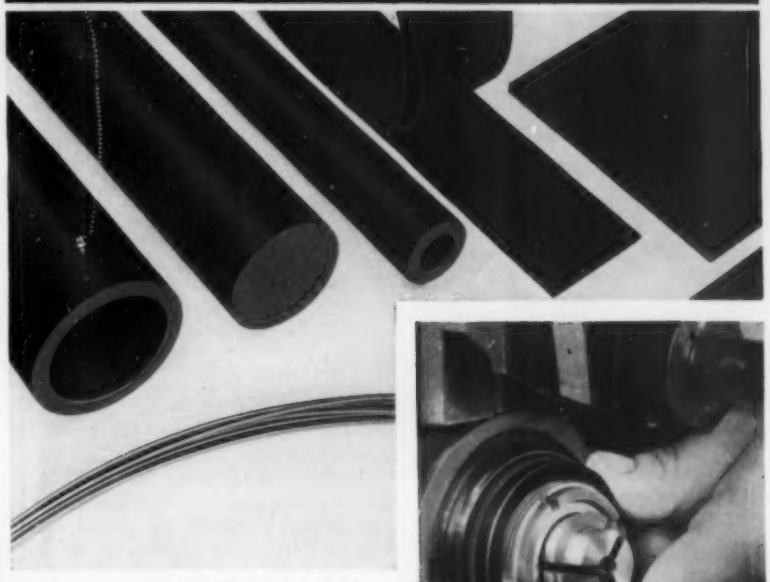
Circle 16, Reader Service Card

Thermoplastic elastomer . . .

has high tensile strength at high ultimate elongation. In addition, the polyurethane material has excellent solvent resistance, particularly gasoline, low air permeability and outstanding abrasion resistance. Available as tough, rubbery, clear amber granules which are converted into end products by milling, calendering, extrusion or molding. Potential uses include wire jacketing, fuel hose, engine mounts, valve diaphragms, pump components and insulators. Now being produced in commercial quantities. **B F Goodrich Co, 3135 Euclid Ave, Cleveland 15.**

Circle 17, Reader Service Card

NYLATRON® GS NYLON



Selection of NYLATRON GS nylon for critical automatic screw machine application (right) again proves its value as an outstanding material for today's designers.

Unique mechanical properties of NYLATRON GS nylon solve vital problems for industrial designers

• A leading manufacturer of automatic screw machines needed a material for use as a seal, which is spring loaded between the spindle and bearing retaining nut. After testing, the design engineers selected NYLATRON GS nylon for these reasons:

NYLATRON GS nylon is tough without being brittle. It formed a positive seal and provided longer wear. NYLATRON GS washers were economically machined to close tolerances from bar stock, provided uniform concentricity and an exacting fit.

The unique characteristics of NYLATRON GS are the result of a special formulation: a molybdenum disulphide filled nylon*, particularly adaptable as a material for bearings, bushings, liners and other parts subjected to extreme wear. Note these improved mechanical characteristics:

★ Greater Rigidity—higher modulus of elasticity, less deformation under load.

★ Higher Heat Distortion Temperatures—distortion temperatures 70% higher than nylon 101.

★ Lower Thermal Expansion—coefficient less than 65% of nylon 101.

★ Lower Surface Friction—can be used without lubrication.

★ Greater Wear and Abrasion Resistance—can outlast, outperform metal.

Stock shapes of NYLATRON GS include rod, strip, tubing, tubular bar and plate in all standard sizes—for rapid, low-cost fabrication on standard metalworking tools. In addition, it is available in powder form for molding.

Polymer can also supply stock shapes of all commercial nylons on request.

Write today for new booklet on NYLATRON GS—or other nylon formulations to meet your specific requirements.

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Design Engineering Show, Philadelphia
May 25 to 28

*Patented for composition and use for machine parts

THE POLYMER CORPORATION OF PENNA.
Reading, Pennsylvania
Export: Polypenco, Inc., Reading, Pa., U.S.A.

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CIRCLE 64 READER SERVICE CARD

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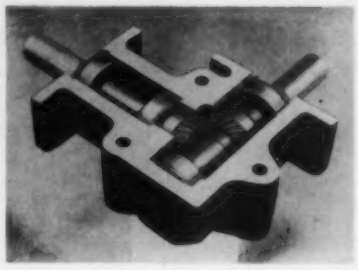
M3A

MICROBEADS, Inc.

P.O. Box 241/Jackson, Miss.

Microscopic Glass Beads for Industrial and Reflective Purposes

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .



Right-angle power transfers . . .

include 17 new models and design improvements. Equipped with hardened-steel gears, nonmagnetic stainless shafts and double-sealed, hardened and ground ball bearings. Line now includes choice of two and three shaft extensions, enclosed 356 aluminum alloy housing, and four or five mounting positions. Right-angle packaged units may be ordered in two or three-way designs. Each of these general types has optional 1:1 to 2:1 ratios. Ratings are from ¼ through 2 hp. **Crown Gear, Div of Harrington Inc, 320 Park Ave, Worcester 10, Mass.**

Circle 18, Reader Service Card

Elastomer for use at 400 F . . .

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Circle 19, Reader Service Card

Teflon-coated cups . . .

for hydraulic and pneumatic equipment are said to reduce breakaway torque required to operate cylinders, to reduce running friction, and not to stick to cylinder walls even after prolonged periods of idleness. Said to eliminate packing chatter and squealing. Teflon is used in a thin layer and coating becomes integral part of packing. Cost is said to be only

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slightly more than ordinary cups. **Garlock Packing Co, 430 Main St, Palmyra, NY.**

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can be hermetically sealed directly to 446 stainless and 430 Ti. Glass is made from minute glass particles pressed to shape and then fired at high temperatures. The particles are consolidated by fusion into nonporous vacuum-tight structure. Said to permit intricate shapes, holes and small radii to be formed economically in glass. Parts retain thermal endurance, corrosion resistance and dielectric strength of parent glass. **Corning Glass Works, Corning, NY.**

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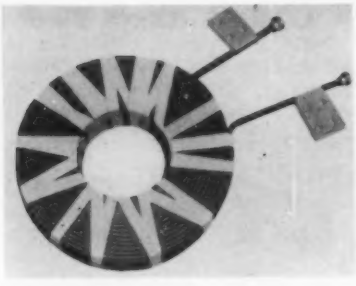

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operates from a 400-cps source at operating voltages to customer specifications. Nominal diameter and length dimensions are less than 1 in.; weight 1.25 oz. Power consumption is 1½ w. Elapsed time indicator is powered by subminiature, single-phase synchronous motor. **Hepta Electronics Inc, 2635 Louisiana Ave, Minneapolis 26.**

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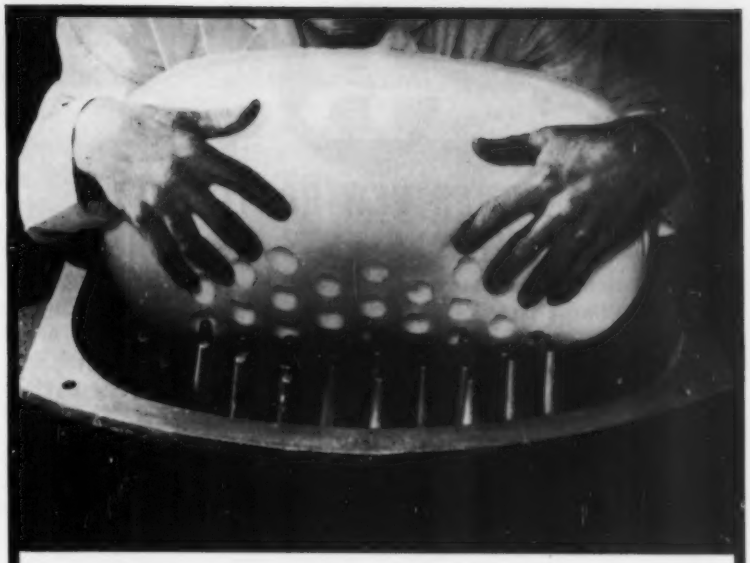

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Transducer kit . . .

for originating and testing systems to measure, indicate, record, control and compute, is contained in transparent plastic case with hinged top, measuring 10 x 5 in. Differential transformers with characteristics suitable for application in pressure pickups, rate gyros, accelerometers, and for feedback in positioning rudders, hydraulic servovalves and similar equipment comprise kit. Transformers are suitable for use in temperatures to 250 F. **Automatic Timing & Controls Inc, Dept 214, King of Prussia, Penna.**

Circle 27, Reader Service Card

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NEW LITERATURE

The Physicist's Conception of Nature

WERNER HEISENBERG. *Published by Harcourt Brace and Co, 750 Third Ave, New York 17. 5 x 8, 192 pp. $3.75.*

Within the course of a few decades, the scientists' attitude toward nature has undergone a radical change. Much of this change can be traced to Werner Heisenberg's Principle of Uncertainty. It was Heisenberg who came upon the startling fact that it was impossible to determine with accuracy the simultaneous location and momentum of an electron.

Heisenberg's principle gave weight to the growing concept that nature, instead of being governed by laws or cause and effect, was in fact governed by mere chance and the laws of probability must be called in to predict the behavior of certain atomic particles, for example. The net result is that science, for the most part, has come to the conculsion that mathematics no longer describes the behavior of an elementary particle but only of knowledge of this behavior. In other words, science is but a link with nature, and cannot simply speak of nature in itself.

Heisenberg writes in an easy-reading style that should appeal to the reader who wants to know a top-flight physicist's concept of the world around him. Although at times his points border on the obvious and one is tempted to skim over passages, this is a minor fault and the reader easily follows him through a series of interesting essays in which he discusses problems such as determinism, relativity, and probability. These are topics bordering on philosophy and, although Heisenberg makes no attempt to hide the limitations of science, he does bring out its possibilities. He shares with the reader his notes on, and excerpts from, important documents in the history of science.—NC

Weekly Information on Patents

A reporting service that will be issued weekly will give class of patent, number, invention, inventor, name of company patent was assigned to and date of issue. Sample issue of the "Patent-dex Reporter" sent on request. Picturesort Co, 375 South St, Newark 5, NJ.

BUTYL RUBBER—Catalog, 12 pp. Discusses properties and characteristics of butyl rubber. Pictures a comprehensive listing of applications, as well as charts and graphs to show weathering and sunlight resistance, chemical and solvent resistance, heat and age resistance, impermeability to gases, and electrical properties. Enjay Co, 15 W 51st St, New York 19.

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CENTER FOR DOCUMENTATION AND COMMUNICATION RESEARCH—Brochure, 32 pp. Explains function of the Center, introduces staff, and discusses facilities, publications and books, projects and liaison activities. Center has program directed toward solution of problems in organization, dissemination, and utilization of recorded information. School of Library Science, Western Reserve University, Cleveland 6.

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IMPREGNATED AND COATED FELT—Sample folder. Information on five new treated felts; 2-in.-sq samples of the felts and seven others are included in the folder. Western Felt Works, Dept M, 4021 W Ogdan Ave, Chicago 23.

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FASTENERS FOR HIGH-TENSILE APPLICATIONS—Design manual 5825, 38 pp. Offers design considerations, reproductions of relevant NAS and MS bolt specifications, tables cross-referencing 160,000, 180,000 and 220,000-psi bolts and other compatible stop nuts. Includes set of high-tensile self-locking fastener standard drawings. Elastic Stop Nut Corp of America, 2330 Vauxhall Rd, Union, NJ.

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TEMPERATURE MEASUREMENT—Catalog 115811, 10 pp. Describes line of temperature probes, with brief section devoted to pitot-static tubes and precision pressure transducers. Gives specifications as a guide to performance characteristics. Rosemount Engineering Co, 4900 W 78th St, Minneapolis 24.

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SOLDERING ALUMINUM—Booklet, 24 pp. Data on soldering fluxes, irons and flames, and actual soldering methods. Types and properties of aluminum solders are explained, as well as corrosion of soldered joints and their performance in aluminum. Text is supplemented by diagrams. Reynolds Metals Co, Dept PRD-6, Box 2346, Richmond 18, Va.

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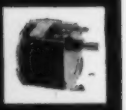

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Publisher's Postscript...

READING and WRITING

No question about it, the ability to read and write is one of modern man's most important possessions. The continuity of civilization is based on this single technique: Without literature there would be little imaginative prose or philosophy, little formal logic and probably very little mathematics. Without newspapers and magazines our world would be a collection of isolated hamlets. Without reference books and technical periodicals there would be practically no science—can you imagine a world without science?

And so a publisher has a rather awesome responsibility. I'm always reminded of it after a conference with editors who tend to burn at white heat about *their* responsibilities as editors. It seems to me they spend most of their time in the effort to save yours, and on PRODUCT ENGINEERING this effort has assumed the proportions of a crusade. Their proudest accomplishment is to fashion an easy-reading, information-packed article that's both timely and immediately useful to the design engineer.

This usually means plenty of clear illustrations, a limited number of words, isolation of details as "optional reading", and a series of other specialized steps to conserve your time in reading. But even more can be done—or so the editors felt—to help you cross the daily mountain of paper on your desk.

A couple of months ago they published a series of articles called *Five Steps to Faster Reading*. The editors figured they'd help you get more information in less time, I suppose, and readers insist that it works. We're still getting hundreds of requests for reprints. If you haven't ordered yours, just write E66 on the Readers Service Card facing this page, add your name and address and mail it in.

A more complete discussion of all aspects of reading improvement is available in the book, *Cut Your Reading Time in Half*, written by the Reading Laboratory (authors of our series) and published by the Development Research Institute. Orders for this book completely cleaned out their stock, even at $1.25 a copy. So if you're waiting for yours, please be patient: it's on the press and will be in the mails very soon. —AH

For Your Information (personal)

Electrified dogs

If you don't consume 62.5 hot dogs a year, you're not an "average American" and probably won't have much use for the gadget pictured here. But Westinghouse thinks there are enough average and super-average Americans around to create a ready market for Dog-O-Matic. Listed at $9.95, it will hold 6 wieners, cook them in 90 sec; and, says Westinghouse, they're cooked from the inside out, retaining all the flavor and juices.

Each dog is impaled on a pair of prongs, like corn bridged between corn holders. The prongs, in turn, are connected to an electrode in the bottom half of the cooker. The electrical circuit is so arranged that, when the top of the case is closed, current passes right through the wiener.

The unit is right up to date in other respects, too: Like so many other new electric appliances, it's designed for easy cleaning (*FYI*, Dec 15 '58): the lid comes off, and the base is completely submersible for washing.

Will those germs really go?

With the development of built-in germ killers to provide lasting protection for molded plastic parts, metal finishes, and other product components (*PE—May 5 '58, p 5, and May 19 '58 p 5*), it becomes important to know exactly what a germ killer is, and what it will do. But, there are now more than 7000 such compounds on the market. Some claim to be *antiseptics, disinfectants,* or *sanitizers* —others are labeled *germicides, fungistats,* and *bacteriostats.*

What do these terms mean—or what should they mean? Here is the latest guide from the US Dept of Agriculture:

Sterilizers, when used as directed, should kill all bacteria. **Bacteriostats** can only be expected to prevent growth of bacteria.

Germicides and **disinfectants** must kill all bacteria except certain spore-forming species. **Sanitizers** simply reduce bacterial counts to "safe" levels.

Fungicides must kill fungi. **Fungistats** need only stop their development.

And what is an **antiseptic?** Practically anything. "It may be either a germicide or a bacteriostat," says USDA, "but the word is usually used for preparations applied to living creatures rather than to inanimate things."

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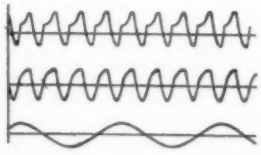
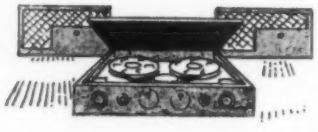
Why Don't They

R ESEARCH and D EVELOP . . .

. . . several useful home adaptations of electronic developments now in the laboratories.



How about a portable, electronic "voice refinery" to make golden-voiced singers and speakers of us all. An unobtrusive throat microphone would carry the electric signal to a pocket controller where filters, frequency-shifters and the like would reshape the sounds. An amplifier and speaker could complete the system. The early, larger models could be built into desk or chair to impress visitors.—E L MARMONT



. . . and foreign language instruction tapes for stereo tape recorders. One channel carries recorded foreign words and phrases with pauses in between. The second channel is used by a student to record his own voice. During playback the student would hear both versions in sequence. Errors in pronunciation would be easy to detect and correct. The student's channel could be erased and recorded as often as necessary.—L GOLDEN

. . . and further application of the relatively new proximity devices now used for burglar alarms. First as a safety device, small children could be sensed as they approach a kitchen door or stair well and the mother warned by a bell or flashing light. Heavy presses and power shears could be stopped when hands are in a dangerous area. In addition, dark streets or paths could be lit up when cars approach. House lights could be turned on when you enter a room.

—R MYRAM

Have you a pet subject but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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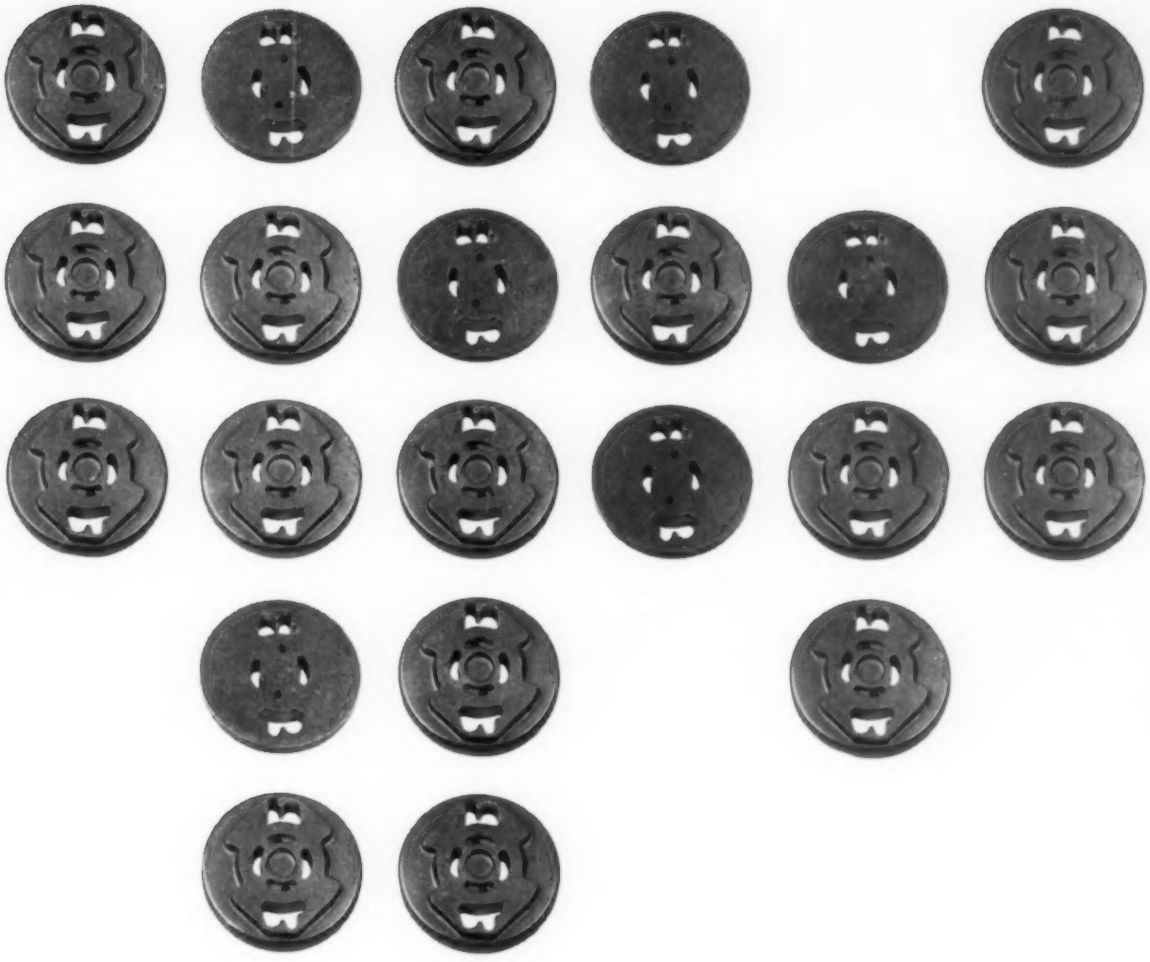

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ECONOMY AND DEPENDABILITY are outstanding characteristics of these pressure plates—important components of power steering pumps. These sintered metal parts are in use today because Moraine Products visualized an improved product and developed a workable design. They also demonstrate other Moraine Products' capabilities—making economically, on time, and in quantity parts that perform dependably under all operating conditions.

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Division of General Motors, Dayton, Ohio

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- adaptations can be made to fit your requirements

single pole

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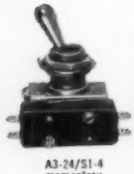
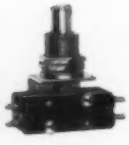
Elec. 10 amps @ 125/250 V.A.C.
Rating: 10 amps @ 30 V.D.C.
Operating Force 9 to 15 oz.
Amb. Temp. −100° to +375° F.
Termination: S1—end solder,
S2—screw
S3—side solder
S5—U-bent
S6—long screw
For switches conforming to Military and U.L. approval, write for details.
Reset types also available.

A2-2/S2-4 roller lever


A3-24/S1-4 momentary

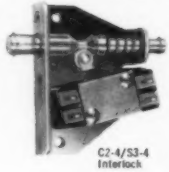

A4-1/S1-4

A4-25/S3-4 removable plastic button

A4-102/S2-3 1" colored button

A5-1/S2-4 roller leaf

A5-7/S2-4


C2-4/S3-4 interlock

In stock? WE HAVE THEM...

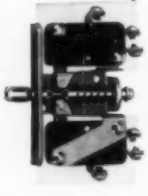
single pole

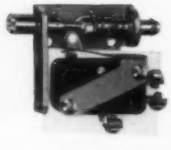
actual size

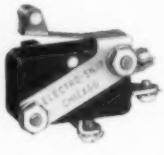
F series
SPDT

L.W.H. 1-3/32" x 13/32" x ⅛"
Elec. 10 amps @ 125/250 V.A.C.
Rating: 60 cycles
10 amps Res. @ 28 V.D.C.
6 amps Ind. @ 28 V.D.C.
Operating Force 7 to 12 oz.
Amb. Temp. −100° to +350° F.
Termination: F1-solder, F2-screw
May be banked with unlimited units per row. For switches conforming to Military and U.L. approval, write for details.

A5-49/F2-3 leaf

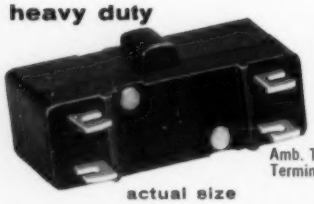

C2-6/F2-3 interlock, DP


C2-10/F2-3 interlock, SP


A5-47/F2-3 roller leaf

A5-56/F2-3 extension leaf

heavy duty



actual size

G series
SPDT, 2 CKT.

L.W.H. 1¾" x 43/64" x 35/64"
Elec. 40 amps @
Rating: 125/250 V.A.C.
40 amps Res. @ 30 V.D.C.
30 amps Ind. @ 30 V.D.C.
Operating Force 45 oz.
Amb. Temp. −100° to +300° F.
Termination: G3—side solder
G4—top and bottom screws
Reset models also available. For switches requiring Military and U.L. approval, write for details.

40 amps? YES...

A3-40/G3-4 maintained

A2-10/G3-4 roller lever

A4-50/G3-4

A4-51/G3-8 DPDT

A4-71/G3-4 removable plastic button

Need a special switch?

Often standard switches can be modified to do the job. If a special switch is required, Electrosnap engineering can create new switches in any quantity to your specifications. Send us your problem ...our answer can save you time and money.

Call Or Write For Specific Details On Any Switch Type

ELECTROSNAP CORPORATION
SWITCH DIVISION • 4246 W. Lake Street, Chicago 24, Illinois
Telephone: VAn Buren 6-3100, TWX No. CG-1400